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ABSTRACT

Reported are the final 2 years of a program which provided identification and remediation services for 60 potentially dyslexic preschool children and 45 dyslexic elementary grade children. Described for the preschool program are materials and evaluative devices and methods of remediation which stressed development of perceptual motor skills, applied skills, gross motor skills, and free play. Detailed are findings showing that the experimental group made 44 positive gains (out of 50 possible test scores) over the control group, 27 of which were significant, especially in such areas as the Wechsler full scale IQ, letter discrimination, word discrimination, copying, and figure ground perception. It is explained that methods of remediation in the 6-week program for elementary grade dyslexic students included daily instruction in reading, perceptual motor skills, gross motor skills, English composition, mathematics as well as weekly field trips. Reported are conclusions showing that experimental students gained significantly over control students in such areas as figure ground perception, arithmetic computation, reading accuracy, and visual tracking. An additional section provides subjective observations and interpretations on such program aspects as teacher qualities, pupil attitudes, test anxiety and overloading, self esteem, professional and public awareness, and problems such as failure to properly mainstream pupils. (DB)

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Final Report

Child Welfare Research and Demonstration Project

THE DETECTION AND REMEDIATION OF LEARNING DISABILITIES

Supported by

Department of Health, Education and Welfare

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Sponsored by

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INTRODUCTION

This report covers the final two years of operation of the three-year Research Demonstration Project entitled "The Detection and Remediation of Learning Disabilities." The first year of operation served primarily as a pilot study wherein the technical problems were surmounted and was described in two previous progress reports. The data herein presented is based on the following programs:

Summer, 1972	Elementary School
1972-1973	Preschool
Summer, 1973	Elementary School
1973-1974	Preschool.

This report presents the hard scientific data derived from analysis of experimental and control groups.

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PART I PRESCHOOL PROGRAM

CHAPTER I

THE PROBLEM

The Statement of the Problem

This research evaluated the effects of methods of remediation of learning disabilities in preschool children, their perceptual ability, their motor skills, and certain aspects of their intellectual functioning.

Basic Hypothesis

It was hypothesized that an experimental group of preschool children diagnosed as perceptually disabled (dyslexic) on the basis of careful screening procedures and subjected to remediation procedures in an 8 month training program and a control group similarly diagnosed as perceptually disabled would be significantly differentiated at the close of the experiment in perceptual ability, motor skills and certain aspects of intellectual functioning and that the experimental group would be significantly more affected in these areas than would the control group, thereby being better equipped for genuine success in the regular school program.

The Need for the Study

An estimated 10-15% of the children in our schools suffer from the perceptual-motor handicap known as dyslexia which results in their experiencing grave difficulties in speech, reading, writing, and spelling. These children have normal visual and auditory acuity and are of normal or superior intelligence but simply cannot acquire information from the printed page when taught by the usual methods. They are regarded by teachers and, sometimes, parents as naughty, bad or delinquent, uncooperative, lazy, or emotionally blocked when, in reality, they are reacting to the constant failure that they experience in trying to learn by the usual methods. They constitute a sizable element of potential high school dropouts.

Children having potential learning problems can be detected at preschool level before they experience crushing academic failure and carry with them scars for life with the lurking fear that they may encounter tasks that even though they try hard will never yield to their efforts. The need is for these children to be exposed to formative and corrective influences so that they will never have to suffer. The evidence to date is that the effectiveness of remediation of perceptually disabled children declines sharply with increasing age to the point where, if they are not detected by the 5th, 6th, or 7th grades, regardless of the teacher or techniques used, only 10 to 16% of them can be brought back to normal grade work.[1] It is imperative to test the effects of remedial techniques applied at the preschool level upon subsequent academic performance and learning ability.

---

[1] Cruickshank, William M., "The Problem of Delayed Recognition and Its Correction", Keeney and Keeney, editors. Dyslexia: Diagnosis and Treatment of Reading Disorders. St. Louis: C. V. Mosby Co., 1968, p. 92.

CHAPTER II

PROCEDURE IN COLLECTING DATA

The Setting

The data for this research was derived from preschool children residing in the Model Cities vicinity of Lewiston, Maine. The Model Cities area has a population of 11,025 individuals which represents 26% of the total city of Lewiston population of 41,779 (1970 census). Nearly 1,000 children under 5 years of age reside in this area. This group provided a pool of several hundred 4-year-old children from which 61 subjects with pronounced dyslexic tendencies were selected. The children in the program were selected by screening a large group of children recruited through extensive publicity. Initial recruits for screening came from Head Start program applicants whose parents were interviewed and had administered to them the School Entrance Check List. Children appearing as possible dyslexic cases were scheduled for full diagnostic testing. Contact was made with pediatricians, optometrists, psychiatrists, and psychologists in the area for referral of cases for testing. Newspaper ads,[1] public service radio announcements,[2] mimeographed flyers[3] distributed through residents in the Model Cities Area, and, finally, public addresses by the project director to Head Start parents meetings, Y.W.C.A. Mothers meetings, PTA meetings, and service clubs were utilized to acquire referrals of children for testing.

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[1] See Appendix A

[2] See Appendix B

[3] See Appendix C

The remedial training program for the children was conducted in a former public school building, the Park Hill School, of Auburn, Maine. For the purposes of this research project the facility was re-named the Learning Center--a title which seemed advantageous in being both concise and meaningful. Through the volunteer labor of the staff, college students, and parents the property was adapted to provide the following facilities:

2 Perceptual-motor training rooms
1 Gross motor training room
1 Applied skills room
1 Free play area
1 Dining area
1 Secretarial area
1 Testing room
1 Parents interview room
1 Kitchen
1 Outside play area
2 Washrooms and toilet facilities

Research Populations

Sixty-one preschool children with an average age of 4.575 years were selected on the basis of presence of extreme symptoms of learning disablement as determined by the screening tests. Thirty-five children were arbitrarily assigned to the experimental group receiving specialized remediation, and 26 children were assigned to the control group not enrolled in a program of remediation. The two groups were roughly the same in average age and percentage of males and females.

Materials and Evaluative Devices

The following evaluative devices were used as indicated:

School Entrance Check List	(Initial screening)
Wechsler Preschool and Primary Scale of Intelligence	(Initial screening plus pre- and post-testing)
Slingerland Pre-Reading Screening Procedures	(Initial screening plus pre- and post-testing)
Frostig Developmental Test of Visual Perception	(Initial screening plus pre- and post-testing)
Motor Task Test	(Initial screening plus pre- and post-testing)
Body Image Test	(Initial screening plus pre- and post-testing)
Walker Readiness Test	(Selective initial screening)
Bender Gestalt Test	(Selective initial screening)
Illinois Test of Psycholinguistic Abilities	(Selective initial screening)

The above tests were administered by four trained testers in conjunction with consultants who assisted in the analysis of test data, advised in interpretation, and in some instances engaged in direct administration of the tests to the children.

School Entrance Check List

The School Entrance Check List was used as an initial screening device to collect relevant social information and to discover the possible presence of characteristics associated with the syndrome of childhood dyslexia. The 18 items on this check list have been extracted from the full Dyslexia Schedule as those most discriminating for purposes of routine survey or screening. Six or more "adverse responses" are regarded as probably a necessary condition for the diagnosis of dyslexia but not a sufficient condition.[1] Content validity, concurrent validity, and construct validity of the Dyslexia Schedule and the School Entrance Check List have been substantiated. The test-retest reliability of the Dyslexia Schedule, from which the School Entrance Check List has been derived, is .92. In this research the information for the School Entrance Check List was acquired by the parent-education specialist through direct interview with the parents.

Wechsler Preschool and Primary Scale of Intelligence

The Wechsler Preschool and Primary Scale of Intelligence is designed especially to adequately appraise the abilities of the preschool child. It is specifically designed for use with children of ages 4 through 6½ years. This intelligence scale consists of eleven tests, six verbal and five performance thus yielding a Verbal I.Q., a Performance I.Q. and a Full

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[1] McLeod, John, Dyslexia Schedule and School Entrance Check List Manual. Cambridge: Educators Publishing Service, Inc., 1969, p. 17.

Scale I.Q. The I.Q.'s here are deviation I.Q.'s which take into consideration the relationship of the child's score to the mean of his age group. The raw scores of each test are converted into scaled scores (a scale with a mean of 10 and a standard deviation of 3). The purposes of the use of this test in the present research were several-fold. First, it was used to assess the general intellectual level of the child to determine if he qualified intellectually for admission to the program. Secondly, it was used diagnostically as an indicator of dyslexic symptoms on the basis of certain typical patterns of responses. Thirdly, it was used as an instrument to assess gains in intellectual development through pre- and post-testing. Complete reliability coefficients have been determined for the individual tests at the various age levels with the verbal I.Q., the Performance I.Q., and the Full Scale I.Q. averaging at all age levels .94, .93, and .96, respectively.

Slingerland Pre-Reading Screening Procedures

The purpose of this device ". . . is to find, among children having average to superior intelligence, the ones who make errors in perception and recall of language symbols, which often indicate specific language disabilities."[1] The screening tests help to identify first graders' academic needs such as general readiness, immediately present specific learning disability, potential learning disability, and deeper problems requiring referral and further testing. The tests are designed for children who have not yet been introduced to reading. Children may be tested individually or in groups up to 20 depending on their maturity.

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[1] Slingerland, Beth H., Teacher's Manual to Accompany Pre-Reading Screening Procedures, Educators Publishing Service, Inc., Cambridge, Mass., 1968, p. 1.

Frostig Developmental Test of Visual Perception

The Frostig Developmental Test of Visual Perception is designed to measure five operationally-defined perceptual skills, as follows:

Eye-Motor Coordination
Figure-Ground
Constancy of Shape
Position in Space
Spatial Relationships

The subtests were selected for their relevance to school performance particularly reading and writing. Scores on the test correlate with reading achievement in the normal first grade classroom between .40 and .50. Since reading is dependent upon perceptual abilities, it becomes important to detect perceptual dysfunction or lag at an early age. The authors contend that their ". . . research has shown that visual perceptual difficulties, regardless of etiology, can be ameliorated by specific training."[1] The results of the test are interpreted in terms of raw scores, scale scores, perceptual age equivalents and perceptual quotients.

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[1] Frostig, Marianne, Maslow, Phyllis, Lefever, D. W., and Whittlesey, J. R. B., Administration and Scoring Manual, The Marianne Frostig Developmental Test of Visual Perception: 1963 Standardization. Palo Alto, California: Consulting Psychologists Press, 1964, p. 6.

Motor Task Test

This test involved the assessment of the following gross motor skills: walking a balance beam forwards, backwards, and sideways; jumping rope; skipping; hopping on the right foot, on the left foot, and on the right foot and left foot alternately; throwing and catching a ball; and, finally, bouncing a ball with the right hand, the left hand, and both hands. These activities were filmed on super 8 movie film pre- and post- and then each activity was viewed on a movie screen and rated on a 5-point scale[1] for skill of performance by 5 judges. The ratings of the judges were averaged for the final score. Although the viewings by the judges were simultaneous, the pre- and post-films presented in random order, their ratings were made independently and discussed after each subject was viewed. Thus, a shared, stable frame of reference for judgment was maintained.

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[1] See Appendix D.

Walker Readiness Test for Disadvantaged Preschool Children

This test was specifically designed for assessing weaknesses of culturally disadvantaged preschool children enrolled in Head Start and Day Care Centers throughout the United States. The test contains items ". . . based on pictures and symbols which do not require reading ability but which would test a child's listening ability; visual acuity; imagery; ability to follow instructions; and recognition of similarities, differences, numerical analogies, and missing parts."[1] The score is the number of correct answers out of a possible 50 points. This score is then interpreted in terms of percentile ranks based upon extensive normative groups. This test was used in this present research project in special cases where cultural disadvantage and verbal limitation due to bilingualism were severe.

Bender-Gestalt Test

The Bender-Gestalt test is based upon designs originally used by Wertheimer in his studies of visual perception. The subject is required to copy each of nine simple designs on a sheet of paper. Although the attempts to quantify responses to the test have been limited, the test is widely used as a clinical instrument to estimate maturation, intelligence, psychological disturbances, the effects of injury to the Cortex, and the effects of convulsive therapy. The research literature supports the contention that considerable discriminating differences in terms of capacities of individuals to respond to the total stimulus situation can be found. In the present research this test was selectively used with various subjects in search of deviant responses indicative of perceptual problems.

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[1] Education News Services, Prep Brief No. 22. "A Readiness Test for Disadvantaged Preschool Children," U.S. Department of Health, Education, and Welfare, Office of Education/National Center for Educational Communication, p. 3.

Illinois Test of Psycholinguistic Abilities

The ITPA is a battery of ten basic tests and two supplementary tests designed to differentiate and assess various facets of cognitive ability relating to Osgood's principles of the communication process. The authors assert that "its objective is to delineate specific abilities and disabilities in children in order that remediation may be undertaken when needed."[1] It serves as a model both for diagnosing learning problems and for programming remedial procedures. The authors further assert that "the ITPA bears the same relation to the field of communication and learning disorders that diagnostic reading tests bear to the field of reading."[1] The twelve subtests of the ITPA are as follows:

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[1] Kirk, S.A., McCarthy, J.J., and Kirk, W.D. Examiner's Manual: Illinois Test of Psycholinguistic Abilities. Revised Edition. University of Illinois, 1968, p. 5.

1. Auditory Reception
2. Visual Reception
3. Visual Sequential Memory
4. Auditory Association
5. Auditory Sequential Memory
6. Visual Association
7. Visual Closure
8. Verbal Expression
9. Grammatical Closure
10. Manual Expression
11. Auditory Closure
12. Sound Blending

In this present research the ITPA was used selectively for diagnostic purposes and remediation procedures.

Content and Methods of Remediation

The staff consisted of the following members:

1 Project director (part-time)
1 Assistant project director
1 Parent education specialist
2 Perceptual-motor specialists
1 Gross motor specialist
2 Teaching-aides
1 Secretary (part-time)
1 Cook (part-time)
1 Cook-aide (part-time)
1 Custodian (part-time)
4 Drivers (part-time)

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[1] Loc. cit.

3 Aides from Neighborhood Youth Corps
6 Volunteer college students[1]

Although members of the staff had prior experience working with preschool children, intense preliminary and continuing training for work with perceptually disabled children was necessary. A week of training before the program began employing outside consultants in the general field of dyslexia and experts in the training of preschool children was carried out. Attendance of both Head Start training sessions and conferences on learning disabilities as well as visitation of nursery schools provided continuous motivation and guidance. In addition, staff meetings were held at the close of each day's sessions for the immediate handling of problems, the discussion of the needs of individual children, and the reporting of progress.

The program was run in two separate sessions. One group of 16 children attended in the morning and another group of similar size attended in the afternoon. The remedial training was based upon four 35 minute periods fitted into a schedule as follows:

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[1] These students averaged approximately 5 hours each week working with individual cases needing special help such as speech therapy. Two extreme cases were transported weekly to a speech therapist who not only worked with the children but instructed the college students in carrying out weekly assignments with each child. This work was carefully supervised by the project director and independent study credit was earned by the students from Bates College.

8:45 - 9:00	Snack
9:00 - 9:35	1st Period
9:35 -10:10	2nd Period
10:10 -10:45	3rd Period
10:45 -11:20	4th Period
11:20 -11:40	Lunch
11:40 -11:45	Brushing teeth
11:45 -12:00	Outside Play
12:00	Return home
12:00 -12:20	Lunch
12:20 -12:25	Brushing teeth
12:25 - 1:00	1st Period
1:00 - 1:35	2nd Period
1:35 - 2:10	3rd Period
2:10 - 2:45	4th Period
2:45 - 3:00	Outside Play
3:00	Return home

Each child spent a full period in each of four classifications of activity consisting of the following:

Perceptual-Motor Training
Applied Skills
Gross Motor Training
Free Play

The activities employed under these four designations were derived from a wide range of sources of which the following were representative:

A Creative Guide for Preschool Teachers, Joanne Wylie, Western Publishing Educational Services, Racine, Wisconsin (1965)

Activities for Developing Visual Perception, Polly Behamann, Academic Therapy Publications, San Rafael, California, 94901 (1970)

Daily Sensorimotor Training Activities, William T. Braley, Geraldine Konicki, and Catherine Leedy, Educational Activities, Inc., Freeport, N. Y. 11520 (1968)

Developmental Sequences of Perceptual-Motor Tasks, Bryant J. Cratty, Educational Activities, Inc., Freeport, N. Y. 11520

Movement, Perception and Thought, Bryant J. Cratty, Educational Activities, Inc., Freeport, N. Y. 11520 (1969)

Perceptual Training Activities Handbook, Betty Van Witsen, Teachers College, Columbia, University, N. Y., N. Y. 10027

Teacher's Guide to accompany Early Childhood Curriculum: A Piaget Program by Celia Stendler Lavatelli, American Science and Engineering, Inc., New York (1970)

The Remediation of Learning Disabilities, Robert E. Valett, Fearson Publishers, Palo Alto, California

Teaching Through Sensory-Motor Experiences, Academic Therapy Publications, San Rafael, California

The heart of the remedial approach was the perceptual-motor training which took place in two small rooms with 2 perceptual-motor specialists, each with 2 children at a time. Thus, with 2 perceptual-motor specialists, 4 children could be dealt with during each of the four 35 minute periods.

The perceptual-motor activities were aimed at developing the following areas of skill:

Visual perception
Auditory perception
Kinesthetic perception
Tactile perception
Laterality
Directionality
Time orientation
Fine motor control
Conceptual: classification, number, measurement, space and seriation.

An important part of this training was The Frostig Program for the Development of Visual Perception which utilizes work-sheets designed to develop skills in the following areas:

Visual-Motor Coordination
Figure-Ground Perception
Perceptual Constancy
Position in Space
Spatial Relationships

It is described by the authors as ". . . intended to be both corrective and preventive"[1] and ". . . for use not only by specialists in the field of visual perception training, but also by regular primary-grade teachers and by teachers of special classes for children with learning difficulties."[2] This material was used daily for part of the perceptual-motor training period with each child.

The further development of the various relevant areas of skill was attempted by making use of carefully selected materials expressly designed and commercially produced for the designated purpose and by employing activities recommended by experts and accomplished workers in the field. The perceptual-motor training curriculum thus included a wide range of materials with their directed uses and other activities of which the following are representative:

Materials
- Block designs
- Number puzzles
- Flash cards
- Sound pictures
- Geometric forms
- Kinesthetic alphabet cards
- Felt shapes
- Beaded numbers
- Tape markers for hand and foot
- Space concept cards

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[1] Frostig, M. and Horne, D. Teacher's Guide. The Frostig Program for the Development of Visual Perception. Chicago: Follett Educational Corporation, 1964, Preface.

[2] Loc. cit.

Playskool clocks
Bean bags
Cuisenaire rods
Cuisenaire geometric form boards
Color pictures
Abacus
Piaget demonstrational materials
Reading Readiness Cards

Activities

Visual memory exercises
Auditory memory exercises
Scanning activities
Sorting activities
Spatial concept activities
Card games
Printing
Paper folding
Indicating time and days of week
Bead stringing
Chalkboard drawing and number writing
Visual Tracking
Coordination activites with bean bags, suspended balls, etc.
Putting correct number of objects in numbered cups and other counting activities
Similarity and difference recognition activities
Picture Interpretation

Furthermore, whatever techniques, in keeping with sound theoretical orientation, that an ingenious teacher could devise were utilized.

The applied skills activity was an extension of the perceptual-motor training into a group setting of four children engaging in game-type activities designed to maintain a high level of motivation. This was planned by the perceptual-motor specialists in conjunction with a teacher-aide and conducted by the teacher-aide who was assisted by a younger member from the Neighborhood Youth Corps.

There was continuous conscious effort to integrate these activites with the specific training the children received from the perceptual-motor specialists. The activities employed here could be grouped within the following four categories:

Arts and crafts
Group games and activities
Dramatic play and language arts
Individualized activities in a group setting

Drawing, pasting, cutting, printing, and weaving were the most frequently employed arts and crafts. "Simon Says," circle games involving coordination and recognition of laterality, singing, bingo, and diversified recognition games were typical group activities. Dramatic play and language arts, effective in developing the expressive qualities of children, included acting out favorite children's stories, imaginative play with dolls and kitchen facilities, and finger plays. Finally, many individualized activities enhanced by the social facilitation of a group setting were found effective. These included assembling children's jig-saw puzzles involving recognition of congruities and figure-ground distinction, building with blocks, practicing activities such as zipping, tying and buttoning, playing with cars and trucks, utilizing a motorized rotary pegboard, operating a VAKT integrator and engaging in numerous sorting and counting activities.

The free play activity was supervised by a teacher-aide assisted by a person from the Neighborhood Youth Corps. The purpose of this activity was primarily to furnish relaxation for the child in the midst of a fairly rigorous structured program. The activities had certain remedial value by supplementing the more structured coordination activities with tricycle riding, sawing and nailing together soft celotex at a workbench, climbing on jungle-bars, playing in a sandbox, bowling, playing with modeling clay and water painting. In addition to the indoor basement area where the aforementioned activities took place, there was an outside play area equipped with swings, slides, climbing bars, and a sand box.

The Gross-motor training was conducted by the specialist in that area working with 4 children at a time in a large carpeted room equipped with gymnasium mats and designed for comfort in the execution of physical exercises. The Gross-motor specialist was assisted by a younger member from the Neighborhood Youth Corps in a wide range of activities including the following:

Coordination exercises to music
Marching to musical rhythms
Dancing
Skipping
Jumping rope
Throwing and catching ball
Bouncing a ball
Walking on a balance beam
Standing on a balance board
Crawling
Walking
Running
Turning
Systematic relaxation

The activities were utilized primarily to develop the gross motor coordination upon which fine motor skills such as handwriting may be based. In addition, these activites served to reduce neuromuscular tension and to increase strength and endurance.

The aforementioned techniques of remediation were fitted into the context of a therapeutic relationship between each staff member and each child. Furthermore, a relationship of trust between the parents and the staff was fostered by the parent-education specialist who also served to integrate the work of the staff with other community agencies.

CHAPTER III

RESULTS: TREATMENT AND INTERPRETATION OF DATA
(1972-1973)

Statistics Indicating the Comparability of Groups

The assumption that experimental and control groups were comparable with regard to sex and age is supported by the data indicated in Table I, page 23. The difference in the composition of the groups in regard to sex is only 2 per cent. The ranges, means, and standard deviations of age are closely comparable. The F and "t" ratios indicate no significant difference between the groups in age.

TABLE I

Description and Comparison of Preschool Experimental and Control Groups with Regard to Sex and Age (1972-1973)

	Experimental		Control	
	Male	Female	Male	Female
N	21	14	15	11
Percentage	60	40	58	42
Age: Mean	4.69	4.39	4.68	4.46
Range	3.33-6.17	4.00-5.00	3.92-5.75	3.58-6.00
Mean	4.56		4.59	
S.D.	.5719		.6437	
F	1.2668			
"t"	.2087*			

* Not significant at .05 level of significance

The similarity of the two groups in terms of sex and intelligence is indicated by Table II, page 25, showing verbal I.Q., Performance I.Q., and full scale I.Q., measured on the Wechsler Preschool and Primary Scale of Intelligence. The F and "t" ratios indicate no significant differences between groups in intelligence.

TABLE II

Description and Comparison
of Preschool Experimental and Control Groups
with Regard to Sex and Intelligence
(1972-1973)

	Experimental			Control	
	Male	Female		Male	Female
N	19	14		15	11
Verbal IQ					
Mean	99.37	94.14		95.20	[illegible]03.64
Range	61-121	81-110		72-124	74-144
Mean	97.15			98.77	
S.D.	13.6247			16.3983	
F			1.4485		
"t"			.4138*		
Performance IQ					
Mean	104.68	106.79		98.60	101.55
Range	69-139	88-127		74-129	66-142
Mean	105.58			99.85	
S.D.	16.0954			16.4867	
F			1.0492		
"t"			1.3262*		
Full Scale IQ					
Mean	102.05	100.29		86.47	103.36
Range	61-129	84-117		73-129	67-147
Mean	101.30			99.38	
S.D.	15.27			17.60	
F			1.3282		
"t"			.4478*		

* Not significant at the .05 level of significance

The similarity of the two groups is further shown by comparisons of pre-test scores on the following tests indicated by the respective tables:

Wechsler Preschool and Primary Scale of Intelligence, Table III, page 27

Slingerland Pre-Reading Screening Procedures, Table IV, page 28

Frostig Developmental Test of Visual Perception, Table V, page 29

Test of Motor Tasks, Table VI, page 30

However, since this research is concerned with gains scores, differences between groups in initial ability would not invalidate a comparison of the groups.

TABLE III

Comparison of Pre-test Scores of Preschool Experimental
and Control Groups on the Wechsler Preschool
and Primary Scale of Intelligence
(1972-1973)

Test		N	(Scaled Score) Mean	Range	S.D.	F
Information	*E	33	9.3030	5-14	2.7327	1.0747
	**C	26	9.8846	3-15	2.8330	
Vocabulary	E	33	9.5757	6-13	1.9044	2.4267
	C	26	10.1923	5-16	2.9667	
Arithmetic	E	33	10.3333	1-17	3.3416	1.0629
	C	26	9.2308	2-16	3.2411	
Similarities	E	33	11.3939	4-19	3.2781	1.0018
	C	26	10.3846	6-19	3.2751	
Comprehension	E	33	10.0606	2-15	3.2415	1.3214
	C	26	9.3913	3-19	3.7263	
Verbal Score	E	33	47.8181	19-67	10.8554	1.[illegible]197
	C	26	49.1154	29-85	12.9346	
Verbal I.Q.	E	33	97.1515	61-121	13.6247	1.4485
	C	26	98.7692	72-144	16.3983	
Animal House	E	33	9.6969	4-17	3.1769	1.2366
	C	26	9.8077	5-18	2.8568	
Picture Completion	E	33	11.6666	7-16	2.3273	1.8598
	C	26	10.9231	5-18	3.1739	
Mazes	E	33	10.6060	1-17	3.2876	1.1923
	C	24	10.2500	6-18	3.0108	
Geometric Design	E	32	11.5625	5-17	2.8841	1.3849
	C	26	10.0000	3-17	3.3941	
Block Design	E	32	10.9062	4-17	2.9877	1.1163
	C	26	9.2692	4-17	3.1567	
Performance Score	E	33	54.0606	27-79	11.9109	1.0885
	C	26	49.8846	25-81	12.4268	
Performance I.Q.	E	33	105.5757	78-139	16.0954	1.1088
	C	26	99.8462	66-142	16.9486	
Full Scale Score	E	33	101.8787	46-138	21.3596	1.3135
	C	26	99.0000	54-166	24.4801	
Full Scale I.Q.	E	33	101.3030	61-129	15.2715	1.3282
	C	26	99.3846	73-147	17.6002	

* Experimental Group
** Control Group

TABLE IV

Comparison of Pre-test Scores of Preschool Experimental and Control Groups on the Slingerland Pre-Reading Screening Procedures (1972-1973)

Category		N	(Errors) Mean	Range	S.D.	F
Letter Discrimination	*E	33	4.3333	2-6	1.0508	2.1693
	**C	26	3.6538	2-5	1.5477	
Word Discrimination	E	33	5.0606	2-7	1.2733	1.7051
	C	26	4.7307	2-8	1.6627	
Discrimination-Memory	E	33	5.5455	2-8	1.5631	1.5243
	C	26	5.2692	2-9	1.9299	
Copying	E	33	5.8788	4-6	.4151	11.5790
	C	26	5.3461	2-7	1.4125	
Copying-Memory	E	33	9.2424	2-10	1.6589	2.5201
	C	26	8.1538	0-10	2.6335	
Auditory Discrimination	E	33	4.1212	2-8	1.8668	1.2020
	C	26	3.8076	1-8	1.7209	
Letter Knowledge	E	33	9.6970	2-16	4.2388	1.0057
	C	26	9.7692	0-16	4.2266	
Reversals	E	33	3.4546	1-8	2.0170	2.4099
	C	26	6.2692	2-12	3.1312	
Transpositions	E	33	4.3636	1-8	1.8169	1.6145
	C	26	2.7307	0-5	1.4299	
Inversions	E	33	3.7576	1-7	1.6399	2.9501
	C	26	4.4230	0-10	2.8167	
Rotations	E	33	.8788	0-2	.8200	4.4840
	C	26	1.1538	0-8	1.7364	
Substitutions	E	33	31.3333	11-43	7.3343	1.9442
	C	26	23.1153	0-45	10.2267	
Total Errors	E	33	43.9394	24-53	7.1324	1.7519
	C	26	40.6153	9-57	9.4406	
Auditory Test (Number Right)	E	32	12.4063	0-24	6.5838	1.3628
	C	26	15.4782	6-24	5.6397	
Auditory Test (Number Wrong)	E	33	11.1563	0-24	6.6726	1.7524
	C	26	7.9565	0-18	5.0405	

* Experimental Group
** Control Group

TABLE V

Comparison of Pre-test Scores of Preschool Experimental and Control Groups on the Frostig Developmental Test of Visual Perception (1972-1973)

			(Scale Score)			
Category		N	Mean	Range	S.D.	F
Eye-Motor Coordination	•E	34	8.5000	0-12	2.1213	1.2420
	••C	24	8.3333	7-13	1.9034	
Figure Ground	E	34	8.9412	0-13	2.5339	1.4200
	C	24	9.0000	6-13	2.1264	
Form Constancy	E	34	9.3235	0-16	3.8275	1.0433
	C	24	10.7083	4-16	3.7472	
Position in Space	E	34	9.1176	0-13	2.4342	1.1267
	C	24	9.7083	7-15	2.2932	
Spatial Relations	E	34	9.6471	0-12	1.7902	2.8533
	C	24	9.5833	6-10	1.0598	
Total	E	34	45.5294	0-63	10.6522	1.7786
	C	24	47.8333	33-65	9.9873	
Perceptual Quotient	E	34	90.8529	0-134	23.9483	2.0333
	C	24	96.1666	65-123	16.7945	

* Experimental Group
** Control Group

TABLE VI

Comparison of Pre-test Scores of Preschool Experimental and Control Groups on Motor Tasks (1972-1973)

Task		N	Mean	Range	S.D.	F
Balance Beam	*E	35	2.5476	1.00-4.33	1.0442	1.4978
Forwards	**C	24	2.8145	1.66-4.66	.8532	
Balance Beam	E	35	1.9690	1.00-3.66	.7728	1.5601
Backwards	C	24	2.3874	1.20-3.33	.6187	
Balance Beam	E	35	2.0166	1.00-3.00	.8541	1.0974
Sideways	C	24	2.5374	1.00-4.00	.8153	
Jumping Rope	E	35	2.6405	1.00-4.33	1.0759	2.4103
	C	24	2.1541	1.00-3.75	.6930	
Skipping	E	35	2.6357	1.00-5.00	1.3727	1.3699
	C	24	1.7784	1.00-5.00	1.1728	
Hopping	E	35	2.5809	1.00-4.00	1.2143	1.3255
Right Foot	C	24	2.5124	1.00-4.33	1.0547	
Hopping	E	35	2.3333	1.00-4.33	1.1681	1.0894
Left Foot	C	24	2.2159	1.00-4.33	1.1191	
Hopping	E	35	1.7833	1.00-3.66	.8768	1.0608
Alternate Feet	C	24	1.6791	1.00-4.00	.9031	
Bouncing Ball	E	35	2.2357	1.00-3.66	.9946	1.6187
Right Hand	C	24	2.0867	1.00-3.66	.7375	
Bouncing Ball	E	35	1.9952	1.00-4.00	.9193	1.0384
Left Hand	C	24	1.8854	1.00-4.00	.9368	
Bouncing Ball	E	35	1.8714	1.00-4.00	.9046	1.3215
Both Hands	C	24	1.9013	1.00-3.40	.7869	
Throwing and	E	35	2.8262	1.00-4.66	1.0709	
Catching	C	24	3.3284	1.00-4.60	.9046	1.4014

* Experimental Group
** Control Group

Statistical Procedure

In order to determine the extent of remediation of learning disability in an experimental group and a control group by evaluating each group prior to the training and after the training for certain aspects of intellectual functioning, perceptual ability, and motor skills, the "t" statistic for dependent paired data was used. The following steps were taken:

1. The scores for each measure, pre- and post-, were obtained for each subject in the group.
2. The difference between each pre- and post-score for each measure was obtained for each subject in the group.
3. This data was entered into a Monroe Model 1930 electronic display calculator for statistics programmed to calculate the t-statistic for dependent paired data according to the following formula:[1]

$$t_d = \frac{\bar{X} - \bar{Y}}{\sqrt{\dfrac{\sigma_x^2 + \sigma_y^2 - 2r\sigma_x\sigma_y}{n}}}$$

where: $\bar{X} = \frac{\sum x}{n}$; $\bar{Y} = \frac{\sum y}{n}$; σ_x = standard deviation of X; σ_Y = standard deviation of Y; r = correlation coefficient.

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[1] Operating Instructions: Model 1930 Electronic Display Calculator for Statistics. Orange, New Jersey: Monroe, The Calculator Company, 1974, p. 22.

Going into the "t" tables with n-1 degrees of freedom, it was possible to determine whether these differences were significant at the five per cent level of confidence. The means and standard deviations of the differences of each measure indicated the extent to which the training objectives were attained and the measure obtained with the "t" formula indicated whether or not these differences were significant at the five per cent level of confidence.

In order to make an intergroup comparison the pre- to post-test differences of the experimental and control groups were entered into the Monroe Model 1930 Calculator set to analyze the data with the t-statistic for independent X and Y data according to the following formula:[1]

$$t_i = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{(n_x - 1)\,\sigma_x^2 + (n_y - 1)\,\sigma_y^2}{n_x + n_y - 2}\left(\frac{1}{n_x} + \frac{1}{n_y}\right)}}$$

where: $X = \frac{\Sigma x}{n_x}$; $Y = \frac{\Sigma y}{n_y}$; σ_x = standard deviation of X sample; σ_y = standard deviation of Y sample.

Going into the "t" tables with n + n - 2 degrees of freedom, it was possible to determine whether these differences were significant at the five per cent level.

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[1] *Loc. cit.*

The initial comparability of groups was determined by assessing means, ranges, standard deviations and F ratios. The F ratio indicated degree of homogeneity according to the following formula:

$$F = \frac{\text{larger variance}}{\text{smaller variance}}^{1}$$

$$F = \frac{\frac{\sum d_1^2}{N_1 - 1}}{\frac{\sum d_2^2}{N_2 - 1}}$$

where: $\sum d^2$ = sum of squares of the sample.

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[1] Guilford, J. P., Fundamental Statistics in Psychology and Education. New York: McGraw-Hill, 1950, p. 232.

Extent of Remediation in Experimental Group

The first problem was to determine the extent of remediation in an experimental group composed of learning disabled preschool children by evaluating the group prior to the training and after the training period for certain aspects of intellectual functioning, perceptual ability, and motor skills.

Statistics on the Verbal Tests of the Wechsler Preschool and Primary Scale of Intelligence

Table VII, page 36, presents the mean pre-test, post-test, and gains scores, the standard deviations of these scores, and the "t" ratios of the experimental group on the verbal tests of the WPPSI. Examination of Table VII reveals that highly significant gains were made on the arithmetic subtest and on the overall verbal score. Gain on the information subtest was positive but beneath the level of statistical significance. The remaining verbal subtests showed nonsignificant gains or nonsignificant losses.

TABLE VII

Mean Pre-test, Post-test, and Gains Scores of Preschool Experimental Group on the Verbal Tests of Wechsler Preschool and Primary Scale of Intelligence
(1972-1973)

			(Scaled Score)			
Test		N	Mean	S.D.	"t"	Level of Sig.**
Information	Pre-	33	9.3030	2.7327		
	Post-	33	10.0000	2.4874		
	*Gains		.6969	1.9761	2.0260	.10
Vocabulary	Pre-	33	9.5757	1.9044		
	Post-	33	10.0000	2.2500		
	Gains		.4242	2.0771	1.1733	N.S.
Arithmetic	Pre-	33	10.3333	3.3416		
	Post-	33	11.3939	2.4101		
	Gains		1.0606	2.1204	2.8733	.01
Similarities	Pre-	33	10.0606	3.2781		
	Post-	33	10.0303	3.6379		
	Gains		-0.0303	3.3305	.0523	N.S.
Comprehension	Pre-	33	8.8485	3.2415		
	Post-	33	8.7273	3.3566		
	Gains		-0.1212	2.2326	.3119	N.S.
Verbal Score	Pre-	33	47.8181	10.8554		
	Post-	33	50.6060	10.8482		
	Gains		2.7878	5.3077	3.0173	.01

* Pre-test scaled score subtracted from post-test scaled score
** Level of significance on two-tailed test

Statistics on the Performance Tests of the Wechsler Preschool and Primary Scale of Intelligence

Table VIII, page 38, presents the mean pre-test, post-test, and gains scores, the standard deviations of these scores, and the "t" ratios of the experimental group on the performance tests of the WPPSI.

Examination of Table VIII reveals that significant gains were made on the animal house subtest and on the overall performance score. Gain on the block design subtest was positive but beneath the level of statistical significance. The remaining performance subtests indicated nonsignificant positive or negative gains.

TABLE VIII

Mean Pre-test, Post-test, and Gains Scores of Preschool Experimental Group on the Performance Tests of Wechsler Preschool and Primary Scale of Intelligence (1972-1973)

Test		N	(Scaled Score) Mean	S.D.	"t"	Level of Sig.**
Animal House	Pre-	33	9.6969	3.1769		
	Post-	33	10.9696	2.4042		
	*Gains		1.2727	3.3473	2.1842	.05
Picture Completion	Pre-	33	11.6666	2.3273		
	Post-	33	11.6060	2.7719		
	Gains		-0.0606	1.9990	.1741	N.S.
Mazes	Pre-	33	10.6060	3.2876		
	Post-	33	11.1818	3.3676		
	Gains		0.5758	3.3543	.9860	N.S.
Geometric Design	Pre-	32	11.5625	2.8841		
	Post-	32	12.2187	2.5994		
	Gains		0.6562	2.4965	1.4869	N.S.
Block Design	Pre-	32	10.9062	2.9877		
	Post-	32	11.8437	2.9524		
	Gains		0.9375	2.8504	1.8605	.10
Performance Score	Pre-	33	54.0606	11.9109		
	Post-	33	57.3030	10.6315		
	Gains		3.2424	7.5333	2.4725	.05

* Pre-test scaled score subtracted from post-test scaled score

** Level of significance on two-tailed test

Statistics on the Verbal, Performance, and Full Scale I.Q. Scores of the Wechsler Preschool and Primary Scale of Intelligence

Table IX, page 40 , presents the mean pre-test, post-test, and gains scores, the standard deviations of these scores, and the "t" ratios of the experimental group on the verbal, performance, and full scale I.Q. scores of the WPPSI. The gain in verbal I.Q. as well as the gains in the full scale score and full scale I.Q. were highly significant. Also, the gain in performance I.Q. was significant.

TABLE IX

Mean Pre-test, Post-test, and Gains Scores of Preschool Experimental Group in Verbal I.Q., Performance I.Q, and Full Scale of the Wechsler Preschool and Primary Scale of Intelligence (1972-1973)

		N	Mean	S.D.	"t"	Level of Sig.**
Verbal I.Q.	Pre-	33	97.1515	13.6247		
	Post-	33	100.5758	13.5209		
	* Gains		3.4243	6.6192	2.9718	.01
Performance I.Q.	Pre-	33	105.5757	16.0954		
	Post-	33	109.9090	14.4727		
	Gains		4.3333	10.1231	2.4590	.05
Full Scale Score	Pre-	33	101.8787	21.3596		
	Post-	33	107.9091	19.9599		
	Gains		6.0303	10.3304	3.3533	.01
Full Scale I.Q.	Pre-	33	101.3030	15.2715		
	Post-	33	105.6667	14.2778		
	Gains		4.3637	7.3731	3.3998	.01

* Pre-test score subtracted from post-test score

** Level of significance on two-tailed test.

Statistics on the Slingerland Pre-Reading Screening Procedures

Table X, page 42, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Slingerland Pre-Reading Screening Procedures. Highly significant gains were indicated in all areas except that of reversals where the gain (decrease in errors) was positive but not statistically significant.

TABLE X

Mean Pre-test, Post-test, and Gains Scores of Preschool Experimental Group on the Slingerland Pre-Reading Screening Procedures

(1972-1973)

Category		N	Mean	S.D.	"t"	Level of Sig.**
Letter Discrimination	Pre-	33	4.3333	1.0508		
	Post-	33	1.9091	1.8602		
	*Gains		2.4242	2.4753	5.6262	.001
Word Discrimination	Pre-	33	5.0606	1.2733		
	Post-	33	3.6970	2.0231		
	Gains		1.3636	2.6788	2.9242	.01
Discrimination -Memory	Pre-	33	5.5455	1.5631		
	Post-	33	3.0303	2.1431		
	Gains		2.5152	2.0329	7.1074	.001
Copying	Pre-	33	5.8788	.4151		
	Post-	33	4.7576	1.4149		
	Gains		1.1212	1.4088	4.5717	.001
Copying-Memory	Pre-	33	9.2424	1.6589		
	Post-	33	8.5455	1.3714		
	Gains		.6970	1.3803	2.9006	.01
Auditory Discrimination	Pre-	33	4.1212	1.8668		
	Post-	33	3.3333	2.0104		
	Gains		.7879	2.5342	1.7860	.10
Letter Knowledge	Pre-	33	9.6970	4.2388		
	Post-	33	3.8788	3.2380		
	Gains		5.8182	4.3550	7.6746	.001
Reversals	Pre-	33	3.4546	2.0170		
	Post-	33	2.6667	2.1016		
	Gains		.7879	3.1201	1.4506	N.S.
Transpositions	Pre-	33	4.3636	1.8169		
	Post-	33	2.3939	2.2492		
	Gains		1.9697	2.9737	3.8051	.001
Inversions	Pre-	33	3.7576	1.6399		
	Post-	33	2.5152	1.9545		
	Gains		1.2424	2.2917	3.1144	.01

* Post-test error score subtracted from Pre-test error score
** Level of significance on two-tailed test

TABLE X (Continued)

Mean Pre-test, Post-test, and Gains Scores of Preschool
Experimental Group on the Slingerland
Pre-Reading Screening Procedures
(1972-1973)

Category		N	Mean	S.D.	"t"	Level of Sig.**
Rotations	Pre-	33	.8788	.8200		
	Post-	33	.9394	1.1163		
	*Gains		-.0606	1.4129	3.0728	.01
Substitutions	Pre-	33	31.3333	7.3343		
	Post-	33	20.6667	7.3513		
	Gains		10.6667	6.9717	8.7892	.001
Total Errors	Pre-	33	43.9394	7.1324		
	Post-	33	29.1212	9.6655		
	Gains		14.8182	8.4018	10.1316	.001
Auditory Test (Number Right)	Pre-	32	12.4063	6.5838		
	Post-	32	16.1563	4.9716		
	Gains		3.7500	4.7655	4.4514	.001
Auditory Test (Number Wrong)	Pre-	32	11.1563	6.6726		
	Post-	32	7.5938	5.0152		
	Gains		3.5625	4.9640	4.0598	.001

* Post-test error score subtracted from Pre-test error score
** Level of significance on two-tailed test

Statistics on the Frostig Developmental Test of Visual Perception

Table XI, page 45 , presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Frostig Developmental Test of Visual Perception. Examination of Table XI reveals that highly significant gains were made in all areas but that of spatial relations wherein the gain was in a positive direction but not to the level of statistical significance.

TABLE XI

Mean Pre-test, Post-test, and Gains Scores of Preschool Experimental Group on the Frostig Developmental Test of Visual Perception

(1972-1973)

Category		N	(Scale Score) Mean	S.D.	"t"	Level of Sig.**
Eye-Motor Coordination	Pre-	34	8.5000	2.1213		
	Post-	34	9.7647	1.5581		
	*Gains		1.2647	2.4778	2.9761	.01
Figure-Ground	Pre-	34	8.9412	2.5339		
	Post-	34	11.1765	1.8663		
	Gains		2.2352	1.9856	6.5639	.001
Form Constancy	Pre-	34	9.3235	3.8275		
	Post-	34	14.6765	2.4336		
	Gains		5.3529	3.5065	8.9013	.001
Position in Space	Pre-	34	9.1176	2.4342		
	Post-	34	10.1176	.9775		
	Gains		1.0000	2.5584	2.7718	.01
Spatial Relations	Pre-	34	9.6471	1.7902		
	Post-	34	10.2647	.9312		
	Gains		.6176	1.9071	1.8884	.10
Total	Pre-	34	45.5294	10.6522		
	Post-	34	56.0294	4.6416		
	Gains		10.5000	8.3675	7.3169	.001
Perceptual Quotient	Pre-	34	90.8529	23.9483		
	Post-	34	114.8529	9.7891		
	Gains		24.0000	19.2148	7.2830	.001

* Pre-test score subtracted from Post-test score

** Level of significance on two-tailed test

Statistics on the Test of Motor Tasks

Table XII, page 47, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Test of Motor Tasks. Examination of this table reveals highly significant gains on all motor tasks.

TABLE XII

Mean Pre-test, Post-test, and Gains Scores of Preschool Experimental Group on Motor Tasks

(1972-1973)

Test		N	Mean	S.D.	"t"	Level of Sig.**
Balance Beam Forwards	Pre-	35	2.5476	1.0442		
	Post-	35	3.5257	.9453		
	*Gains		.9781	1.2570	4.6033	.01
Balance Beam Backwards	Pre-	35	1.9690	.7728		
	Post-	35	2.7014	.7925		
	Gains		.7324	1.0242	4.2303	.01
Balance Beam Sideways	Pre-	35	2.0166	.8541		
	Post-	35	3.0229	.8870		
	Gains		1.0063	.8460	7.0360	.001
Jumping Rope	Pre-	35	2.6405	1.0759		
	Post-	35	3.7576	.9626		
	Gains		1.1171	1.2185	5.8565	.001
Skipping	Pre-	35	2.6357	1.3727		
	Post-	35	3.6433	1.0269		
	Gains		1.0076	1.1285	4.8972	.001
Hopping Right Foot	Pre-	35	2.5809	1.2143		
	Post-	35	3.6076	1.0093		
	Gains		1.0267	1.1830	5.1342	.001
Hopping Left Foot	Pre-	35	2.3333	1.1681		
	Post-	35	3.5271	1.0082		
	Gains		1.1938	1.1567	6.1062	.001
Hopping Alternate Feet	Pre-	35	1.7833	.8768		
	Post-	35	2.7900	.9475		
	Gains		1.0067	.9663	6.1631	.001
Bouncing Ball Right Hand	Pre-	35	2.2357	.9946		
	Post-	35	3.1362	1.1204		
	Gains		.9005	.9335	5.7063	.001
Bouncing Ball Left Hand	Pre-	35	1.9952	.9193		
	Post-	35	2.7366	1.1054		
	Gains		.7414	.8593	5.1046	.001
Bouncing Ball Both Hands	Pre-	35	1.8714	.9046		
	Post-	35	2.6433	1.1826		
	Gains		.7719	.9029	5.0576	.001
Throwing and Catching	Pre-	35	2.8262	1.0709		
	Post-	35	3.6743	.6090		
	Gains		.8481	1.1252	4.4589	.001

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* Pre-test score subtracted from Post-test score

** Level of significance on two-tailed test

Extent of Remediation in Control Group

The second problem was to determine the extent of remediation in a control group composed of learning disabled preschool children, by evaluating the group prior to the training and after the training period for certain aspects of intellectual functioning, perceptual ability, and motor skills.

Statistics on the Verbal Tests of the Wechsler Preschool and Primary Scale of Intelligence

Table XIII, page 50, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the verbal tests of the Wechsler Preschool and Primary Scale of Intelligence. Examination of this table reveals that a significant gain was made on the arithmetic subtest. Gains on the other subtests were positive but not to the level of statistical significance.

TABLE XIII

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group on the Verbal Tests of Wechsler Preschool and Primary Scale of Intelligence

(1972-1973)

			(Scaled Score)			Level
Test		N	Mean	S.D.	"t"	of Sig.**
Information	Pre-	26	9.8846	2.8330		
	Post-	26	10.1538	3.5405		
	* Gains		.2692	2.4586	.5584	N.S.
Vocabulary	Pre-	26	10.1923	2.9667		
	Post-	26	10.3462	3.0192		
	Gains		.1538	2.6936	.2912	N.S.
Arithmetic	Pre-	26	9.2308	3.2411		
	Post-	26	10.1923	2.8003		
	Gains		.9615	2.0490	2.3928	.05
Similarities	Pre-	26	10.3846	3.2751		
	Post-	26	11.0769	3.3217		
	Gains		.6923	2.7967	1.2622	N.S.
Comprehension	Pre-	23	9.3913	3.7263		
	Post-	23	10.0000	2.9233		
	Gains		.6087	2.7591	1.0580	N.S.
Verbal Score	Pre-	26	49.1154	12.9346		
	Post-	26	51.6154	12.8688		
	Gains		2.5000	7.1958	1.7715	.10

* Pre-test scaled score subtracted from post-test scaled score

** Level of significance on two-tailed test

Statistics on the Performance Tests of the Wechsler Preschool and Primary Scale of Intelligence

Table XIV, page 52, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the performance tests of the WPPSI. Inspection of the table reveals that a highly significant gain was made on the subtest of block design. All other gains scores were nonsignificant negative gains or nonsignificant positive gains.

TABLE XIV

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group on the Performance Tests of Wechsler Preschool and Primary Scale of Intelligence

(1972-1973)

Test		N	(Scaled Score) Mean	S.D.	"t"	Level of Sig.**
Animal House	Pre-	26	9.8077	2.8568		
	Post-	26	10.4615	3.2029		
	*Gains		.6538	2.7414	1.2161	N.S.
Picture Completion	Pre-	26	10.9231	3.1739		
	Post-	26	11.0385	3.1684		
	Gains		.1154	2.3035	.2554	N.S.
Mazes	Pre-	24	10.2500	3.0108		
	Post-	24	9.7500	3.7213		
	Gains		- .5000	2.8893	.8478	N.S.
Geometric Design	Pre-	26	10.0000	3.3941		
	Post-	26	9.1154	3.3980		
	Gains		- .8846	2.4872	1.8136	.10
Block Design	Pre-	26	9.2692	3.1567		
	Post-	26	10.6923	3.5639		
	Gains		1.4231	2.6408	2.7478	.01
Performance Score	Pre-	26	49.8846	12.4268		
	Post-	26	51.6538	12.4545		
	Gains		1.7692	6.8545	1.3161	N.S.

* Pre-test scaled score subtracted from post-test scaled score
** Level of significance on two-tailed test

Statistics on the Verbal, Performance, and Full Scale I. Q. Scores of the Wechsler Preschool and Primary Scale of Intelligence

Table XV, page 54, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the verbal, performance, and full scale I.Q. scores of the WPPSI. Inspection of the table indicates positive but statistically nonsignificant gains in all categories.

TABLE XV

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group in Verbal I.Q., Performance I.Q., and Full Scale of the Wechsler Preschool and Primary Scale of Intelligence (1972-1973)

		N	Mean	S.D.	"t"	Level of Sig.**
Verbal I.Q.	Pre-	26	98.7692	16.3983		
	Post-	26	101.9615	16.0860		
	*Gains		3.1923	9.6872	1.6803	N.S.
Performance I.Q.	Pre-	26	99.8462	16.9486		
	Post-	26	101.6154	16.4829		
	Gains		1.7692	8.4867	1.0630	N.S.
Full Scale Score	Pre-	26	99.0000	24.4801		
	Post-	26	103.2692	23.9441		
	Gains		4.2692	10.9199	1.9935	.10
Full Scale I.Q.	Pre-	26	99.3846	17.6002		
	Post-	26	102.2692	17.0589		
	Gains		2.8846	7.9465	1.8510	.10

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* Pre-test score subtracted from post-test score

** Level of significance on two-tailed test

Statistics on the Slingerland Pre-Reading Screening Procedures

Table XVI, page 56, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Slingerland Pre-Reading Screening Procedures. Inspection of this table indicates highly significant gains in the following categories:

Discrimination - Memory
Auditory Discrimination
Reversals
Inversions
Total errors

Significant gains were also made on the Auditory Test. Nonsignificant gains in either a positive or negative direction were indicated in the 8 remaining categories.

TABLE XVI

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group on the Slingerland Pre-Reading Screening Procedures (1972-1973)

Category		N	Mean	S.D.	"t"	Level of Sig.**
Letter Discrimination	Pre-	26	3.6538	1.5477		
	Post-	26	2.8461	2.5564		
	*Gains		.8076	2.4334	1.6924	N.S.
Word Discrimination	Pre-	26	4.7307	1.6627		
	Post-	26	4.3076	1.5942		
	Gains		.4230	1.2384	1.7418	.10
Discrimination -Memory	Pre-	26	5.2692	1.9299		
	Post-	26	3.6153	2.0990		
	Gains		1.6538	2.4485	3.4440	.01
Copying-	Pre-	26	5.3461	1.4125		
	Post-	26	5.2307	2.1034		
	Gains		.1153	1.7961	.3275	N.S.
Copying-Memory	Pre-	26	8.1538	2.6335		
	Post-	26	8.6923	2.7823		
	Gains		- .5384	2.8032	.9794	N.S.
Auditory Discrimination	Pre-	26	3.8076	1.7209		
	Post-	26	2.1923	1.9187		
	Gains		1.6153	2.6088	3.1572	.01
Letter Knowledge	Pre-	26	9.7692	4.2266		
	Post-	26	8.2307	4.6588		
	Gains		1.5384	4.2164	1.8604	.10
Reversals	Pre-	26	6.2692	3.1312		
	Post-	26	4.1538	2.1668		
	Gains		2.1153	3.8086	2.8320	.01
Transpositions	Pre-	26	2.7307	1.4299		
	Post-	26	3.6538	2.1714		
	Gains		- .9230	2.3819	1.9759	.10
Inversions	Pre-	26	4.4230	2.8167		
	Post-	26	2.8076	1.6252		
	Gains		1.6153	2.7287	3.0185	.01

* Post-test error score subtracted from Pre-test error score

** Level of significance on two-tailed test

TABLE XVI (Continued)

Mean Pre-test, Post-test, and Gains Scores of Preschool
Control Group on the Slingerland Pre-Reading
Screening Procedures
(1972-1973)

Category		N	Mean	S.D.	"t"	Level of Sig.**
Rotations	Pre-	26	1.1538	1.7364		
	Post-	26	1.2692	1.6138		
	*Gains		- .1153	2.2685	.2593	N.S.
Substitutions	Pre-	26	23.1153	10.2267		
	Post-	26	21.9615	10.6863		
	Gains		1.1538	8.9696	.6559	N.S.
Total Errors	Pre-	26	40.6153	9.4406		
	Post-	26	35.2307	13.3904		
	Gains		5.3846	9.7039	2.8298	.01
Auditory Test (Number Right)	Pre-	23	15.4782	5.6397		
	Post-	23	17.7391	4.8262		
	Gains		2.6208	4.2127	2.5738	.05
Auditory Test (Number Wrong)	Pre-	23	7.9565	5.0405		
	Post-	23	5.7391	4.1910		
	Gains		2.2173	4.1990	2.5325	.05

* Post-test error score subtracted from Pre-test error score

** Level of significance on two-tailed test

Statistics on the Frostig Developmental Test of Visual Perception

Table XVII, page 59, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Frostig Developmental Test of Visual Perception. Inspection of Table XVII reveals significant gains in the area of form constancy and in the perceptual quotient. There was negative gain in the area of position in space but not to the level of significance.

TABLE XVII

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group on the Frostig Developmental Test of Visual Perception

(1972-1973)

Category		N	(Scale Score) Mean	S.D.	"t"	Level of Sig.
Eye-Motor Coordination	Pre-	24	8.8333	1.9034		
	Post-	24	9.1250	1.8252		
	Gains		.2916	1.9886	.7185	N.S.
Figure-Ground	Pre-	24	9.0000	2.1264		
	Post-	24	9.4166	2.5693		
	Gains		.4166	1.9981	1.0215	N.S.
Form Constancy	Pre-	24	10.7083	3.7472		
	Post-	24	12.7500	2.6905		
	Gains		2.0416	3.2097	3.1161	.01
Position in Space	Pre-	24	9.7083	2.2932		
	Post-	24	9.0833	1.6396		
	Gains		- .6250	2.2421	1.3656	N.S.
Spatial Relations	Pre-	24	9.5833	1.0598		
	Post-	24	10.1250	1.7769		
	Gains		.5416	1.7932	1.4798	N.S.
Total	Pre-	24	47.8333	7.9873		
	Post-	24	50.4583	8.2038		
	Gains		2.6250	6.5129	1.9745	.10
Perceptual Quotient	Pre-	24	96.1666	16.7945		
	Post-	24	102.5000	15.0881		
	Gains		6.3333	13.1435	2.3606	.05

• Pre-test score subtracted from Post-test score

•• Level of significance on two-tailed test

Statistics on the Test of Motor Tasks

Table XVIII, page 61, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the test of Motor Tasks. Inspection of this table reveals highly significant gains in only hopping on the right foot and hopping on the left foot. Gains scores on all other tasks were nonsignificant.

TABLE XVIII

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group on Motor Tasks (1972-1973)

Test		N	Mean	S.D.	"t"	Level of Sig.**
Balance Beam Forwards	Pre-	24	2.8145	.8532		
	Post-	24	2.9610	.7431		
	*Gains		.1465	.6367	1.1272	N.S.
Balance Beam Backwards	Pre-	24	2.3874	.6187		
	Post-	24	2.4381	.5520		
	Gains		.0506	.6086	.4078	N.S.
Balance Beam Sideways	Pre-	24	2.5374	.8153		
	Post-	24	2.4201	.8273		
	Gains		- .1173	.7204	.7981	N.S.
Jumping Rope	Pre-	24	2.1541	.6930		
	Post-	24	2.4965	.9480		
	Gains		.3423	1.0512	1.5953	N.S.
Skipping	Pre-	24	1.7784	1.1728		
	Post-	24	2.1145	1.2498		
	Gains		.3361	1.1180	1.4727	N.S.
Hopping Right Foot	Pre-	24	2.5124	1.0547		
	Post-	24	2.9944	.8987		
	Gains		.4819	.7917	2.9820	.01
Hopping Left Foot	Pre-	24	2.2159	1.1191		
	Post-	24	2.7547	.9461		
	Gains		.5388	.9337	2.8272	.01
Hopping Alternate Feet	Pre-	24	1.6791	.9031		
	Post-	24	2.0048	1.0020		
	Gains		.3256	.9826	1.6236	N.S.
Bouncing Ball Right Hand	Pre-	24	2.0867	.7375		
	Post-	24	2.4631	.7495		
	Gains		.3763	.9452	1.9507	.10
Bouncing Ball Left Hand	Pre-	24	1.8854	.9368		
	Post-	24	2.1680	.6018		
	Gains		.2826	.7928	1.7462	.10
Bouncing Ball Both Hands	Pre-	24	1.9013	.7869		
	Post-	24	2.1326	.7518		
	Gains		.2312	.6682	1.6952	N.S.
Throwing and Catching	Pre-	24	3.3284	.9046		
	Post-	24	3.5249	.5123		
	Gains		.1965	.9410	1.0230	N.S.

* Pre-test score subtracted from Post-test score

** Level of significance on two-tailed test

Intergroup Comparison of Extent of Remediation

It was hypothesized that the experimental and control groups would be significantly differentiated at the close of the experiment in certain aspects of intellectual functioning, perceptual ability, and motor skills and that the experimental group would be significantly more affected in these areas than would the control group.

Statistics on the Wechsler Preschool and Primary Scale of Intelligence

Table XIX, page 63 , presents the intergroup differences with respect to mean gains scores on the Wechsler Preschool and Primary Scale of Intelligence. Examination of Table XIX reveals that the experimental group trained with special methods of remediation made a larger gain than the control group to a statistically significant level on one subtest only--that of geometric design. The experimental group made larger gains than the control group on the subtests of information, vocabulary, arithmetic, animal house, and mazes and on the verbal I.Q., the performance I.Q., and the full scale I.Q.; but these gains did not achieve statistical significance. The control group made larger but statistically nonsignificant gains than the experimental group on the subtests of similarities, comprehension, picture completion, and block design.

TABLE XIX

Preschool Intergroup Differences of Mean Gains Scores on the Wechsler Preschool and Primary Scale of Intelligence (1972-1973)

Test	E-C*	"t"	Level of Significance**
Information	.4277	.7411	N.S.
Vocabulary	.2704	.4355	N.S.
Arithmetic	.0991	.1808	N.S.
Similarities	- .7226	.8867	N.S.
Comprehension	- .7299	1.0919	N.S.
Verbal Score	.2878	.1768	N.S.
Verbal I.Q.	.2319	.1090	N.S.
Animal House	.6189	.7622	N.S.
Picture Completion	- .1760	.3139	N.S.
Mazes	.6257	1.2656	N.S.
Geometric Design	1.5408	2.3415	.05
Block Design	- .4856	.6666	N.S.
Performance Score	1.4732	.7755	N.S.
Performance I.Q.	2.5641	1.0357	N.S.
Full Scale Score	1.7611	.6339	N.S.
Full Scale I.Q.	1.4790	.7392	N.S.

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* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Statistics on the Slingerland Pre-Reading Screening Procedures

Table XX, page 65 , presents the intergroup differences with respect to the mean gains scores on the Slingerland Pre-Reading Screening Procedures. Examination of Table XX reveals that the experimental group made larger gains than the control group to a statistically significant level in the categories of letter discrimination, discrimination-memory, copying-memory, letter knowledge, transpositions and substitutions, and in terms of total errors. Very high levels of significance were attained for most of these differences. The control group made larger gains than the experimental group in the categories of auditory discrimination, reversals, and inversions, but these gains were not statistically significant. The gains in the remaining categories were in favor of the experimental group but not to a statistically significant level.

TABLE XX

Preschool Intergroup Differences of Mean Gains Scores on the Slingerland Pre-Reading Screening Procedures (1972-1973)

Category	Mean E-C*	"t"	Level of Significance **
Letter Discrimination	1.6166	2.5090	.05
Word Discrimination	.9406	1.6542	N.S.
Discrimination-Memory	.8614	1.4763	N.S.
Copying	1.0059	2.4118	.05
Copying-Memory	1.2354	2.2168	.05
Auditory Discrimination	- .8274	1.2292	N.S.
Letter Knowledge	4.2798	3.8000	.001
Reversals	-1.3274	1.4719	N.S.
Transpositions	2.8927	4.0408	.001
Inversions	- .3729	.5705	N.S.
Rotations	.0547	.1136	N.S.
Substitutions	9.5128	4.5859	.001
Total Errors	9.4336	3.9988	.001
Auditory Test (Number Right)	1.4892	1.1987	N.S.
Auditory Test (Number Wrong)	1.3452	1.0555	N.S.

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Statistics on the Frostig Developmental Test of Visual Perception

Table XXI, page 67, presents the intergroup differences with respect to the mean gains scores on the Frostig Developmental Test of Visual Perception. Examination of Table XXI reveals that the experimental group made larger gains than the control group to a statistically significant level in the areas of figure-ground perception, form constancy, and position in space, as well as on the total scaled score and the perceptual quotient. Very high levels of statistical significance were attained for most of these gains. The experimental group, also, made larger, but statistically nonsignificant gains over the control group in the areas of eye-motor coordination and spatial relations.

TABLE XXI

Preschool Intergroup Differences of Mean Gains Scores on the Frostig Developmental Test of Visual Perception (1972-1973)

Test	Mean E-C*	"t"	Level of Significance **
Eye-Motor Coordination	.9731	1.5940	N.S.
Figure Ground	1.8186	3.4264	.01
Form Constancy	3.3113	3.6661	.001
Position in Space	1.6250	2.5046	.05
Spatial Relations	.0760	.1531	N.S.
Total Scaled Score	7.8750	3.8559	.001
Perceptual Quotient	17.6667	3.9011	.001

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Statistics on the Test of Motor Tasks

Table XXII, page 69, presents the intergroup differences with respect to mean gains scores on the Test of Motor Tasks. Examination of Table XXII reveals that the experimental group made statistically significant greater gains than the control group on all tasks except that of hopping on the right foot. The gain here, however, closely approached significance.

TABLE XXII

Preschool Intergroup Differences of Mean Gains Scores on Motor Tasks (1972-1973)

Task	Mean E-C*	"t"	Level of Significance**
Balance Beam Forwards	.8315	2.9834	.01
Balance Beam Backwards	.6817	2.9214	.01
Balance Beam Sideways	1.1235	5.3143	.001
Jumping Rope	.7748	2.6625	.05
Skipping	.6715	2.1505	.05
Hopping (Right Foot)	.5447	1.9707	.10
Hopping (Left Foot)	.6550	2.3044	.05
Hopping (Alternate Feet)	.6810	2.6410	.05
Bouncing Ball (Right Hand)	.5241	2.1075	.05
Bouncing Ball (Left Hand)	.4588	2.0779	.05
Bouncing Ball (Both Hands)	.5407	2.4989	.05
Throwing and Catching	.6516	2.3307	.05

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Summary

The intergroup differences are conveniently summarized in Table XXIII, page 71 , Table XXIV, page 72 , and Table XXV, page 73 . On the basis of the total data concerning the experimental group and the control group as well as the intergroup comparisons the following observations may be made:

1. Out of 50 possible test scores the experimental group made 46 positive gains, 38 of which were significant. One score was a significant negative gain, and 3 scores were nonsignificant negative gains.
2. Out of 50 possible scores the control group made 43 positive gains 13 of which were significant. Seven were nonsignificant negative gains.
3. An intergroup comparison showed the experimental group with 43 positive gains over the control group, 24 of which were significant. Seven scores were nonsignificant negative gains.

TABLE XXIII

Summary of Test Gains Favoring the Experimental Group with Significant Intergroup Differences

(1972-1973)

Test	Level of Significance
Wechsler Preschool and Primary Scale of Intelligence	
Geometric Design	.05
Slingerland Pre-Reading Screening Procedures	
Letter Discrimination	.05
Copying	.05
Copying-Memory	.05
Letter Knowledge	.001
Transpositions	.001
Substitutions	.001
Total Errors	.001
Frostig Developmental Test of Visual Perception	
Figure-Ground	.01
Form Constancy	.001
Position in Space	.05
Total Scaled Score	.001
Perceptual Quotient	.001
Motor Tasks Test	
Balance Beam (Forwards)	.01
Balance Beam (Backwards)	.01
Balance Beam (Sideways)	.001
Jumping Rope	.05
Skipping	.05
Hopping (Right Foot)	.10*
Hopping (Left Foot)	.05
Hopping (Alternate Feet)	.05
Bouncing Ball (Right Hand)	.05
Bouncing Ball (Left Hand)	.05
Bouncing Ball (Both Hands)	.05
Throwing and Catching	.05

* Approaching but less than significance

TABLE XXIV

Summary of Test Gains Favoring the Experimental Group with Nonsignificant Intergroup Differences

(1972-1973)

Test	Level of Significance
Wechsler Preschool and Primary Scale of Intelligence	
Information	N.S.
Vocabulary	N.S.
Arithmetic	N.S.
Verbal Score	N.S.
Verbal I.Q.	N.S.
Animal House	N.S.
Mazes	N.S.
Performance Score	N.S.
Performance I.Q.	N.S.
Full Scale Score	N.S.
Full Scale I.Q.	N.S.
Slingerland Pre-Reading Screening Procedures	
Word Discrimination	N.S.
Discrimination-Memory	N.S.
Rotations	N.S.
Auditory Test (Number Right)	N.S.
Auditory Test (Number Wrong)	N.S.
Frostig Developmental Test of Visual Perception	
Eye-Motor Coordination	N.S.
Spatial Relations	N.S.
Motor Tasks Test	
Hopping (Right Foot)	.10*

* Approaching but less than significance

TABLE XXV

Summary of Test Gains Favoring the Control Group
with Nonsignificant Intergroup Differences
(1972-1973)

Test	Level of Significance
Wechsler Preschool and Primary Scale of Intelligence	
Similarities	N.S.
Comprehension	N.S.
Picture Completion	N.S.
Block Design	N.S.
Slingerland Pre-Reading Screening Procedures	
Auditory Discrimination	N.S.
Reversals	N.S.
Inversions	N.S.

Conclusions

The following conclusions are drawn from the statistical analysis of the data:

1. The methods of remediation employed in this research enabled the pupils exposed to this training to gain significantly over pupils in a control group in the Perceptual Function involved in performance on the subtest of Geometric Design in the Wechsler Preschool and Primary Scale of Intelligence.
2. The methods of remediation employed in this research enabled pupils exposed to this training to gain significantly over pupils in a control group in Letter Discrimination, Copying, Copying-Memory, Letter Knowledge, as well as in the Reduction of Transpositions, Substitution and Total Errors on the Slingerland Pre-Reading Screening Procedures.
3. The methods of remediation employed in this research enabled pupils exposed to this training to gain significantly over pupils in a control group in Perception of Figure-Ground, Form Constancy, and Position in Space as well as in the Total Scaled Score and the Perceptual Quotient as measured by the Frostig Developmental Test of Visual Perception.
4. The methods of remediation employed in this research enabled pupils exposed to this training to gain significantly over a control group in equilibrium as indicated by performance on the balance beam forwards,

backwards and sideways, and in the motor tasks of jumping rope, skipping, hopping (left foot), hopping (alternate feet), and bouncing a ball with the right hand, left hand, and both hands as well as in throwing and catching.

5. Remediation methods enabled pupils to gain, but not significantly, over pupils in a control group in the following areas of the Wechsler Pre-School and Primary Scale of Intelligence: Information, Vocabulary, Arithmetic, Verbal Score, Verbal I.Q., Animal House, Mazes, Performance Score, Performance I.Q., Full Scale Score, and Full Scale I.Q.

6. Remediation methods enabled pupils to gain, but not significantly, over pupils in a control group in Word Discrimination, Discrimination-Memory, Reduction of Rotations and in performance on the Auditory Test of the Slingerland Pre-Reading Procedures.

7. Remediation methods enabled pupils to gain, but not significantly, over a control group in Eye-Motor Coordination and Spatial Relations as measured by the Frostig Developmental Test of Visual Perception.

8. Remediation methods enabled pupils to gain, but not significantly, over a control group in Motor Coordination as indicated by hopping on the right foot.

CHAPTER IV

RESULTS: TREATMENT AND INTERPRETATION OF DATA
(1973-1974)

Statistics Indicating the Comparability of Groups

The assumption that experimental and control groups were comparable with regard to sex and age is supported by the data indicated in Table I, page 77. The difference in the composition of the groups in regard to sex was only 4 per cent. The ranges, means, and standard deviations of age are closely comparable. The F and "t" ratios indicate no significant difference between the groups in age.

TABLE I

Description and Comparison of Preschool Experimental and Control Groups with Regard to Sex and Age (1973-1974)

	Experimental		Control	
	Male	Female	Male	Female
N	19	16	15	11
Percentage	54	46	58	42
Age: Mean	4.43	4.31	4.68	4.46
Range	3.92-6.50	3.50-4.92	3.92-5.75	3.58-6.00
Mean	4.38		4.59	
S.D.	.5244		.6437	
F	1.5071			
"t"	1.4269*			

* Not significant at .05 level of significance.

The similarity of the two groups in terms of sex and intelligence is indicated by Table II, page 79, showing verbal I.Q., performance I.Q., and full scale I.Q., measured on the Wechsler Preschool and Primary Scale of Intelligence. The F and "t" ratios indicate no significant differences between groups in intelligence.

TABLE II

Description and Comparison of Preschool Experimental and Control Groups with Regard to Sex and Intelligence (1973-1974)

	Experimental			Control	
	Male	Female		Male	Female
N	19	16		15	11
Verbal I.Q.					
Mean	101.05	95.63		95.20	103.64
Range	76-131	76-114		72-124	74-144
Mean	98.57			98.77	
S.D.	12.4977			16.3983	
F			1.7213		
"t"			.0534*		
Performance I.Q.					
Mean	102.21	98.44		98.60	101.55
Range	85-116	76-129		74-129	66-142
Mean	100.49			99.85	
S.D.	11.9444			16.9486	
F			2.0134		
"t"			.1729*		
Full Scale I.Q.					
Mean	101.84	96.44		86.47	103.36
Range	86-127	73-123		73-129	67-147
Mean	99.37			99.38	
S.D.	11.9166			17.60	
F			2.1800		
"t"			.0034*		

* Not significant at the .05 level of significance

The similarity of the two groups is further shown by comparisons of pre-test scores on the following tests indicated by the respective tables:

Wechsler Preschool and Primary Scale of Intelligence,
Table III, page 81

Slingerland Pre-Reading Screening Procedures,
Table IV, page 82

Frostig Developmental Test of Visual Perception,
Table V, page 83

Test of Motor Tasks, Table VI, page 84

However, since this research is concerned with gains scores, differences between groups in initial ability would not invalidate a comparison of the groups.

TABLE III

Comparison of Pre-test Scores of Preschool Experimental and Control Groups on the Wechsler Preschool and Primary Scale of Intelligence (1973-1974)

			(Scaled Score)			
Test		N	Mean	Range	S.D.	F
Information	*E	35	9.7142	6-14	2.3091	1.5065
	**C	26	9.8846	3-15	2.8330	
Vocabulary	E	35	10.4285	6-14	2.1595	1.8872
	C	26	10.1923	5-16	2.9667	
Arithmetic	E	35	9.3142	6-16	2.5755	1.5836
	C	26	9.2308	2-16	3.2411	
Similarities	E	35	10.5428	6-19	3.4071	1.0822
	C	26	10.3846	6-19	3.2751	
Comprehension	E	35	8.9714	3-14	3.0339	1.5085
	C	23	9.3913	3-19	3.7263	
Verbal Score	E	35	48.9714	31-75	9.9984	1.6735
	C	26	49.1154	29-85	12.9346	
Verbal I.Q.	E	35	98.5714	76-131	12.4977	1.7216
	C	26	98.7692	74-144	16.3983	
Animal House	E	35	8.7428	5-13	2.1052	1.8415
	C	26	9.8077	5-18	2.8568	
Picture Completion	E	35	11.2571	4-18	3.2389	1.0413
	C	26	10.9231	5-18	3.1739	
Mazes	E	35	9.4000	4-15	3.4231	1.2926
	C	24	10.2500	6-18	3.0108	
Geometric Design	E	35	10.2000	4-16	2.7738	1.4972
	C	26	10.0000	3-17	3.3941	
Block Design	E	35	10.2857	7-15	2.2566	1.9568
	C	26	9.2692	4-17	3.1567	
Performance Score	E	35	50.2571	32-71	8.7256	2.0282
	C	26	49.8846	25-81	12.4268	
Performance IQ	E	35	100.4857	76-129	11.9444	2.0134
	C	26	99.8462	66-142	16.9486	
Full Scale Score	E	35	99.2285	75-137	16.5068	2.1993
	C	26	99.0000	54-166	24.4801	
Full Scale I.Q.	E	35	99.3714	82-127	11.9165	2.1814
	C	26	99.3846	73-147	17.6002	

* Experimental Group
** Control Group

TABLE IV

Comparison of Pre-test Scores of Preschool Experimental and Control Groups on the Slingerland Pre-Reading Screening Procedures (1974-1974)

Category		N	(Errors) Mean	Range	S.D.	F
Letter Discrimination	*E	35	3.4875	1-6	1.1212	1.9054
	**C	26	3.6538	2-5	1.5477	
Word Discrimination	E	35	5.0000	1-7	1.3060	1.6208
	C	26	4.7307	2-8	1.6627	
Discrimination -Memory	E	35	5.3428	2-8	1.6617	1.3488
	C	26	5.2692	2-9	1.9299	
Copying	E	35	5.7142	3-7	.7100	3.9578
	C	26	5.3461	2-7	1.4125	
Copying-Memory	E	35	9.4857	6-10	1.0108	6.7879
	C	26	8.1538	0-10	2.5335	
Auditory Discrimination	E	35	3.5714	1-10	2.1044	1.4953
	C	26	3.8076	1-8	1.7209	
Letter Knowledge	E	35	10.0000	2-15	3.5891	1.3867
	C	26	9.7692	0-16	4.2266	
Reversals	E	35	5.0285	2-9	1.9476	2.5847
	C	26	6.2692	2-12	3.1312	
Transpositions	E	35	3.7714	1-7	1.6103	1.2682
	C	26	2.7307	0-5	1.4299	
Inversions	E	35	4.8285	2-9	2.0649	1.8607
	C	26	4.4230	0-10	2.8167	
Rotations	E	35	1.2857	1-3	1.1264	2.3763
	C	26	1.1538	0-8	1.7364	
Substitutions	E	35	25.1142	6-37	8.3517	1.4994
	C	26	23.1153	0-45	10.2267	
Total Errors	E	35	42.6285	20-53	6.3249	2.2278
	C	26	40.6153	9-57	9.4406	
Auditory Test (Number Right)	E	35	15.5207	4-24	4.7465	1.4117
	C	26	15.4782	6-24	5.6397	
Auditory Test (Number Wrong)	E	35	7.4827	1-18	4.2813	1.3861
	C	26	7.9565	0-18	5.0405	

* Experimental Group
** Control Group

TABLE V

Comparison of Pre-test Scores of Preschool Experimental and Control Groups on the Frostig Developmental Test of Visual Perception (1973-1974)

Category		(Scale Score) N	Mean	Range	S.D.	F
Eye-Motor Coordination	*E	35	8.5714	7-11	.9482	4.0295
	**C	24	8.8333	7-13	1.9034	
Figure-Ground	E	35	9.5142	6-12	1.6692	1.6228
	C	24	9.0000	6-13	2.1264	
Form Constancy	E	35	10.4857	6-16	3.0905	1.4701
	C	24	10.7083	4-16	3.7472	
Position in Space	E	35	9.8000	6-13	2.1529	1.1345
	C	24	9.7083	7-15	2.2932	
Spatial Relations	E	35	9.9428	8-10	.3380	9.8513
	C	24	9.5833	6-10	1.0598	
Total	E	35	48.3142	39-60	4.9632	2.5898
	C	24	47.8333	33-65	7.9873	
Perceptual Quotient	E	35	97.0857	73-123	11.9049	1.9901
	C	24	96.1666	65-123	16.7945	

* Experimental Group
** Control Group

TABLE VI

Comparison of Pre-test Scores of Preschool Experimental and Control Groups on Motor Tasks (1973-1974)

Task		N	Mean	Range	S.D.	F
Balance Beam Forwards	*E	35	2.7719	1.00-5.00	.9963	1.3635
	**C	24	2.8145	1.66-4.66	.8532	
Balance Beam Backwards	E	35	1.9545	1.00-3.12	.5921	1.0918
	C	24	2.3874	1.20-3.33	.6187	
Balance Beam Sideways	E	35	2.3135	1.00-4.00	.7965	1.0477
	C	24	2.5374	1.00-4.00	.8153	
Jumping Rope	E	35	2.0918	1.00-5.00	.8542	1.5193
	C	24	2.1541	1.00-3.75	.6930	
Skipping	E	35	2.5666	1.00-5.00	1.3536	1.3320
	C	24	1.7784	1.00-5.00	1.1728	
Hopping Right Foot	E	35	2.9250	1.00-4.75	1.1702	1.2310
	C	24	2.5124	1.00-4.33	1.0547	
Hopping Left Foot	E	35	2.6523	1.00-4.75	1.1149	1.0075
	C	24	2.2159	1.00-4.33	1.1191	
Hopping Alternate Feet	E	35	2.3202	1.00-4.87	.9699	1.1534
	C	24	1.6791	1.00-4.00	.9031	
Bouncing Ball Right Hand	E	35	2.0206	1.00-4.00	.9620	1.7014
	C	24	2.0867	1.00-3.66	.7375	
Bouncing Ball Left Hand	E	35	1.6011	1.00-4.00	.7110	1.7360
	C	24	1.8854	1.00-4.00	.9368	
Bouncing Ball Both Hands	E	35	1.5345	1.00-4.00	.7490	1.1037
	C	24	1.9013	1.00-3.40	.7869	
Throwing and Catching	E	35	3.4067	1.00-5.00	1.2182	1.8135
	C	24	3.3284	1.00-4.60	.9046	

* Experimental Group

** Control Group

Statistical Procedure

In order to determine the extent of remediation of learning disability in an experimental group and a control group by evaluating each group prior to the training and after the training for certain aspects of intellectual functioning, perceptual ability, and motor skills, the "t" statistic for dependent paired data was used. The following steps were taken:

1. The scores for each measure, pre- and post-, were obtained for each subject in the group.
2. The difference between each pre- and post-score for each measure was obtained for each subject in the group.
3. This data was entered into a Monroe Model 1930 electronic display calculator for statistics programmed to calculate the t-statistic for dependent paired data according to the following formula:[1]

$$t_d = \frac{\bar{X} - \bar{Y}}{\sqrt{\dfrac{\sigma_x^2 + \sigma_y^2 - 2r\sigma_x\sigma_y}{n}}}$$

where: $\bar{X} = \frac{\sum x}{n}$; $\bar{Y} = \frac{\sum y}{n}$; σ_x = standard deviation of X; σ_y = standard deviation of Y; r = correlation coefficient.

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[1] *Operating Instructions: Model 1930 Electronic Display Calculator for Statistics*. Orange, New Jersey: Monroe, The Calculator Company, 1974, p. 22.

Going into the "t" tables with n-1 degrees of freedom, it was possible to determine whether these differences were significant at the five per cent level of confidence. The means and standard deviations of the differences of each measure indicated the extent to which the training objectives were attained and the measure obtained with the "t" formula indicated whether or not these differences were significant at the five per cent level of confidence.

In order to make an intergroup comparison the pre- to post-test differences of the experimental and control groups were entered into the Monroe Model 1930 Calculator set to analyze the data with the t-statistic for independent X and Y data according to the following formula:[1]

$$t_i = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{(n_x - 1)\,\sigma_x^2 + (n_y - 1)\,\sigma_y^2}{n_x + n_y - 2}\left(\frac{1}{n_x} + \frac{1}{n_y}\right)}}$$

where: $X = \frac{\sum x}{n_x}$; $Y = \frac{\sum y}{n_y}$; σ_x = standard deviation of X sample; σ_y = standard deviation of Y sample. Going into the "t" tables with n + n - 2 degrees of freedom, it was possible to determine whether these differences were significant at the five percent level.

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[1] *Loc. cit.*

The initial comparability of groups was determined by assessing means, ranges, standard deviations and F ratios. The F ratio indicated degree of homogeneity according to the following formula:

$$F = \frac{\text{larger variance}}{\text{smaller variance}}^{1}$$

$$F = \frac{\frac{\sum d_1^2}{N_1 - 1}}{\frac{\sum d_2^2}{N_2 - 1}}$$

where: $\sum d^2$ = sum of squares of the sample.

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[1] Guilford, J. P., Fundamental Statistics in Psychology and Education. New York: McGraw-Hill, 1950, p. 232.

Extent of Remediation in Experimental Group

The first problem was to determine the extent of remediation in an experimental group composed of learning disabled children by evaluating the group prior to the training and after the training period for certain aspects of intellectual functioning, perceptual ability, and motor skills.

Statistics on the Verbal Tests of the Wechsler Preschool and Primary Scale of Intelligence

Table VII, page 89, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the verbal tests of the WPPSI. Examination of Table VII reveals that significant gains were made on all verbal subtests except that of arithmetic where the gain was in favor of the experimental group but not to the level of significance. The gain of the experimental group over that of the control group on the verbal score was highly significant.

TABLE VII

Mean Pre-test, Post-test, and Gains Scores of Preschool
Experimental Group on the Verbal Tests of Wechsler
Preschool and Primary Scale of Intelligence
(1973-1974)

Test		N	(Scaled Score) Mean	S.D.	"t"	Level of Sig.**
Information	Pre-	35	9.7142	2.3081		
	Post-	35	10.5714	2.3798		
	*Gains		.8571	1.9725	2.5708	.05
Vocabulary	Pre-	35	10.4285	2.1595		
	Post-	35	10.4000	1.7690		
	Gains		.0285	2.2943	.0728	N.S.
Arithmetic	Pre-	35	9.3142	2.5755		
	Post-	35	11.2285	1.8324		
	Gains		1.9142	2.4896	4.5488	.001
Similarities	Pre-	35	10.5428	3.4071		
	Post-	35	11.7714	2.6243		
	Gains		1.2285	3.4986	2.0774	.05
Comprehension	Pre-	35	8.9714	3.0339		
	Post-	35	11.0000	2.0436		
	Gains		2.0285	2.5608	4.6883	.001
Verbal Score	Pre-	35	48.9714	9.9984		
	Post-	35	54.9714	7.9649		
	Gains		6.0000	7.2273	4.9113	.001

* Pre-test scaled score subtracted from post-test scaled score

** Level of significance on two-tailed test

Statistics on the Performance Tests of the Wechsler Preschool and Primary Scale of Intelligence

Table VIII, page 91, presents the mean pre-test, post-test, and gains scores, the standard deviations of these scores, and the "t" ratios of the experimental group on the performance tests of the WPPSI. Examination of Table VIII reveals that significant gains were made on all subtests except geometric design where the gain was positive but nonsignificant.

TABLE VIII

Mean Pre-test, Post-test, and Gains Scores of Preschool Experimental Group on the Performance Tests of Wechsler Preschool and Primary Scale of Intelligence (1973-1974)

Test		N	(Scaled Score) Mean	S.D.	"t"	Level of Sig.**
Animal House	Pre-	35	8.7428	2.1052		
	Post-	35	11.4000	1.9583		
	*Gains		2.6571	2.2088	7.1167	.001
Picture Completion	Pre-	35	11.2571	3.2389		
	Post-	35	12.4857	2.6939		
	Gains		1.2285	3.2275	2.2519	.05
Mazes	Pre-	35	9.4000	3.4231		
	Post-	35	11.7428	2.5706		
	Gains		2.3428	3.8496	3.6004	.001
Geometric Design	Pre-	35	10.2000	2.7738		
	Post-	35	11.0857	2.8332		
	Gains		.8857	3.3234	1.5766	N.S.
Block Design	Pre-	35	10.2857	2.2566		
	Post-	35	12.8571	2.4027		
	Gains		2.5714	2.6489	5.7429	.001
Performance Score	Pre-	35	50.2571	8.7256		
	Post-	35	59.5714	9.6688		
	Gains		9.3142	7.8694	7.0023	.001

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* Pre-test scaled score subtracted from post-test scaled score

** Level of significance on two-tailed test

Statistics on the Verbal, Performance, and Full Scale I.Q. Scores of the Wechsler Preschool and Primary Scale of Intelligence

Table IX, page 93, presents the mean pre-test, post-test, and gains scores, the standard deviations of these scores, and the "t" ratios of the experimental group on the verbal, performance, and full scale I.Q. scores of the WPPSI. The gains in verbal I.Q., performance I.Q., as well as full scale score and I.Q. were highly significant.

TABLE IX

Mean Pre-test, Post-test, and Gains Scores of Preschool Experimental Group in Verbal I.Q., Performance I.Q., and Full Scale of the Wechsler Preschool and Primary Scale of Intelligence
(1973-1974)

		N	Mean	S.D.	"t"	Level of Sig.**
Verbal I.Q.	Pre-	35	98.5714	12.4977		
	Post-	35	106.0000	9.9734		
	Gains		7.4285	9.0919	4.8337	.001
Performance I.Q.	Pre-	35	100.4857	11.9444		
	Post-	35	113.0857	13.1022		
	Gains		12.6000	10.6555	6.9956	.001
Full Scale Score	Pre-	35	99.2285	16.5068		
	Post-	35	114.5428	15.1431		
	Gains		15.3142	12.2541	7.3934	.001
Full Scale I.Q.	Pre-	35	99.3714	11.9165		
	Post-	35	110.4000	10.8714		
	Gains		11.0285	8.7732	7.4369	.001

* Pre-test score subtracted from post-test score

** Level of significance on two-tailed test

Statistics on the Slingerland Pre-Reading Procedures

Table X, page 95, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Slingerland Pre-Reading Screening Procedures. Significant gains, and in most cases highly significant gains were indicated in all categories.

TABLE X

Mean Pre-test, Post-test, and Gains Scores of Preschool
Experimental Group on the Slingerland
Pre-Reading Screening Procedures
(1973-1974)

Category		N	Mean	S.D.	"t"	Level of Sig.
Letter Discrimination	Pre-	35	3.4857	1.1212		
	Post-	35	1.7143	1.2735		
	Gains		1.7714	1.2387	8.4602	.001
Word Discrimination	Pre-	35	5.0000	1.3060		
	Post-	35	3.5429	1.6687		
	Gains		1.4571	1.9605	4.3970	.001
Discrimination -Memory	Pre-	35	5.3428	1.6617		
	Post-	35	2.9714	1.5808		
	Gains		2.3714	2.1294	6.5884	.001
Copying	Pre-	35	5.7142	.7100		
	Post-	35	4.0000	1.7489		
	Gains		1.7142	1.5256	6.6473	.001
Copying-Memory	Pre-	35	9.4857	1.0108		
	Post-	35	7.4000	2.2122		
	Gains		2.0857	2.1471	5.7469	.001
Auditory Discrimination	Pre-	35	3.5714	2.1044		
	Post-	35	2.4571	2.2141		
	Gains		1.1143	2.5983	2.5371	.05
Letter Knowledge	Pre-	35	10.0000	3.5891		
	Post-	35	7.1143	3.6199		
	Gains		2.8857	2.6873	6.3527	.001
Reversals	Pre-	35	5.0285	1.9476		
	Post-	35	3.9714	2.1349		
	Gains		1.0571	2.9599	2.1129	.05
Transpositions	Pre-	35	3.7714	1.6103		
	Post-	35	2.3143	1.7110		
	Gains		1.4571	2.2536	3.8251	.001
Inversions	Pre-	35	4.8285	2.0649		
	Post-	35	3.1142	2.1250		
	Gains		1.7143	2.7210	3.6735	.01

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* Post-test error score subtracted from Pre-test error score
** Level of significance on two-tailed test

TABLE X (Continued)

Mean Pre-test, Post-test, and Gains Scores of Preschool Experimental Group on the Slingerland Pre-Reading Screening Procedures (1973-1974)

Category		N	Mean	S.D.	"t"	Level of Sig.**
Rotations	Pre-	35	1.2857	1.1264		
	Post-	35	1.3714	1.4967		
	*Gains		- .0857	1.8370	.2760	.01
Substitutions	Pre-	35	25.1142	8.3517		
	Post-	35	18.3714	6.4447		
	Gains		6.7428	7.9348	5.0273	.001
Total Errors	Pre-	35	42.6285	6.3249		
	Post-	35	29.3428	9.3429		
	Gains		13.2857	7.4224	10.5894	.001
Auditory Test (Number Right)	Pre-	35	15.5207	4.7465		
	Post-	35	17.7931	4.3538		
	Gains		2.1724	5.4646	2.1408	.05
Auditory Test (Number Wrong)	Pre-	35	7.4827	4.2813		
	Post-	35	5.3793	3.5296		
	Gains		2.1034	4.2623	2.6575	.05

* Post-test error score subtracted from Pre-test error score

** Level of significance on two-tailed test

Statistics on the Frostig Developmental Test of Visual Perception

Table XI, page 98, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Frostig Developmental Test of Visual Perception. Examination of Table XI reveals that highly significant gains were made in the areas of eye-motor coordination, figure-ground, and form constancy. Gains in total score and perceptual quotient were highly significant. There was positive gain in position in space but not to the level of significance. Finally, there was a nonsignificant loss in spatial relations.

TABLE XI

Mean Pre-test, Post-test, and Gains Scores of Preschool
Experimental Group on the Frostig Developmental
Test of Visual Perception
(1973-1974)

Category		N	(Scale Score) Mean	S.D.	"t"	Level of Sig.**
Eye-Motor Coordination	Pre-	35	8.5714	.9482		
	Post-	35	9.5428	1.7208		
	*Gains		.9714	1.9324	2.9739	.01
Figure-Ground	Pre-	35	9.5142	1.6692		
	Post-	35	11.3142	2.5755		
	Gains		1.8000	2.3860	4.4626	.001
Form Constancy	Pre-	35	10.4857	3.0905		
	Post-	35	14.2285	2.3274		
	Gains		3.7428	3.3461	6.6174	.001
Position in Space	Pre-	35	9.8000	2.1529		
	Post-	35	10.1428	1.2866		
	Gains		.3428	2.6562	.7636	N.S.
Spatial Relations	Pre-	35	9.9428	.3380		
	Post-	35	9.8857	1.0784		
	Gains		- .0571	1.0273	.3290	N.S.
Total	Pre-	35	48.3142	4.9632		
	Post-	35	55.0285	5.3163		
	Gains		6.7142	6.1384	6.4710	.001
Perceptual Quotient	Pre-	35	97.0857	11.9049		
	Post-	35	112.6571	9.9141		
	Gains		15.5714	14.3040	6.4402	.001

* Pre-test score subtracted from Post-test score
** Level of significance on two-tailed test

Statistics on the Test of Motor Tasks

Table XII, page 100, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Test of Motor Tasks. Examination of Table XII reveals highly significant gains on all motor tasks.

TABLE XII

Mean Pre-test, Post-test, and Gains Scores of Preschool
Experimental Group on Motor Tasks
(1973-1974)

Test		N	Mean	S.D.	"t"	Level of Sig.**
Balance Beam Forwards	Pre-	35	2.7719	.9963		
	Post-	35	3.9404	.6867		
	*Gains		1.1685	1.0979	6.2966	.001
Balance Beam Backwards	Pre-	35	1.9545	.5921		
	Post-	35	3.2856	.4596		
	Gains		1.3311	.6892	11.4252	.001
Balance Beam Sideways	Pre-	35	2.3135	.7965		
	Post-	35	3.5714	.7128		
	Gains		1.2578	.8068	9.2230	.001
Jumping Rope	Pre-	35	2.0918	.8542		
	Post-	35	3.7452	.7653		
	Gains		1.6533	.9087	10.7635	.001
Skipping	Pre-	35	2.5666	1.3536		
	Post-	35	3.3642	1.1713		
	Gains		.7976	1.2765	3.6965	.001
Hopping Right Foot	Pre-	35	2.9250	1.1702		
	Post-	35	3.8809	.9187		
	Gains		.9559	1.1029	5.1275	.001
Hopping Left Foot	Pre-	35	2.6523	1.1149		
	Post-	35	3.8261	.9783		
	Gains		1.1737	.9220	7.5315	.001
Hopping Alternate Feet	Pre-	35	2.3202	.9699		
	Post-	35	3.1499	.9002		
	Gains		.8297	.9807	5.0050	.001
Bouncing Ball Right Hand	Pre-	35	2.0206	.9620		
	Post-	35	2.9975	.9579		
	Gains		.9769	.9968	5.7982	.001
Bouncing Ball Left Hand	Pre-	35	1.6011	.7110		
	Post	35	2.7118	.9521		
	Gains		1.1107	.8522	7.7104	.001
Bouncing Ball Both Hands	Pre-	35	1.5345	.7490		
	Post-	35	2.5440	.9929		
	Gains		1.0095	.8624	6.9250	.001
Throwing and Catching	Pre-	35	3.4067	1.2182		
	Post-	35	4.4377	.7020		
	Gains		1.0309	1.2105	5.0383	.001

* Pre-test score subtracted from Post-test score
** Level of significance on two-tailed test

Extent of Remediation in Control Group

The second problem was to determine the extent of remediation in a control group composed of learning disabled preschool children, by evaluating the group prior to the training and after the training period for certain aspects of intellectual functioning, perceptual ability, and motor skills.

Statistics on the Verbal Tests of the Wechsler Preschool and Primary Scale of Intelligence

Table XIII, page 102, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the verbal tests of the Wechsler Preschool and Primary Scale of Intelligence. Examination of Table XIII reveals that a significant gain was made on the arithmetic subtest. Gains on the other subtests were positive but not to the level of statistical significance.

TABLE XIII

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group on the Verbal Tests of Wechsler Preschool and Primary Scale of Intelligence (1973-1974)

Test		N	(Scaled Score) Mean	S.D.	"t"	Level of Sig.**
Information	Pre-	26	9.8846	2.8330		
	Post-	26	10.1538	3.5405		
	* Gains		.2692	2.4586	.5584	N.S.
Vocabulary	Pre-	26	10.1923	2.9667		
	Post-	26	10.3462	3.0192		
	Gains		.1538	2.6936	.2912	N.S.
Arithmetic	Pre-	26	9.2308	3.2411		
	Post	26	10.1923	2.8003		
	Gains		.9615	2.0490	2.3928	.05
Similarities	Pre-	26	10.3846	3.2751		
	Post-	26	11.0769	3.3217		
	Gains		.6923	2.7967	1.2622	N.S.
Comprehension	Pre-	23	9.3913	3.7263		
	Post-	23	10.0000	2.9233		
	Gains		.6087	2.7591	1.0580	N.S.
Verbal Score	Pre-	26	49.1154	12.9346		
	Post-	26	51.6154	12.8688		
	Gains		2.5000	7.1958	1.7715	.10

* Pre-test scaled score subtracted from post-test scaled score
** Level of significance on two-tailed test

Statistics on the Performance Tests of the Wechsler Preschool and Primary Scale of Intelligence

Table XIV, page 104, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the performance tests of the WPPSI. Inspection of the table reveals that a highly significant gain was made on the subtest of block design. All other gains scores were nonsignificant negative gains or nonsignificant positive gains.

TABLE XIV

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group on the Performance Tests of Wechsler Preschool and Primary Scale of Intelligence (1973-1974)

Test		N	(Scaled Score) Mean	S.D.	"t"	Level of Sig.**
Animal House	Pre-	26	9.8077	2.8568		
	Post-	26	10.4615	3.2029		
	*Gains		.6538	2.7414	1.2161	N.S.
Picture Completion	Pre-	26	10.9231	3.1739		
	Post-	26	11.0385	3.1684		
	Gains		.1154	2.3035	.2554	N.S.
Mazes	Pre-	24	10.2500	3.0108		
	Post-	24	9.7500	3.7213		
	Gains		- .5000	2.8893	.8478	N.S.
Geometric Design	Pre-	26	10.0000	3.3941		
	Post-	26	9.1154	3.3980		
	Gains		- .8846	2.4872	1.8136	.10
Block Design	Pre-	26	9.2692	3.1567		
	Post-	26	10.6923	3.5639		
	Gains		1.4231	2.6408	2.7478	.01
Performance Score	Pre-	26	49.8846	12.4268		
	Post-	26	51.6538	12.4545		
	Gains		1.7692	6.8545	1.3161	N.S.

* Pre-test scaled score subtracted from post-test scaled score

** Level of significance on two-tailed test

Statistics on the Verbal, Performance, and Full Scale I.Q. Scores of the Wechsler Preschool and Primary Scale of Intelligence

Table XV, page 106, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the verbal, performance, and full scale I.Q. scores of the WPPSI. Inspection of the table indicates positive but statistically nonsignificant gains in all categories.

TABLE XV

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group in Verbal I.Q., Performance I.Q., and Full Scale of the Wechsler Preschool and Primary Scale of Intelligence
(1973-1974)

		N	Mean	S.D.	"t"	Level of Sig.**
Verbal I.Q.	Pre-	26	98.7692	16.3983		
	Post-	26	101.9615	16.0860		
	*Gains		3.1923	9.6872	1.6803	N.S.
Performance I.Q.	Pre-	26	99.8462	16.9486		
	Post-	26	101.6154	16.4829		
	Gains		1.7692	8.4867	1.0630	N.S.
Full Scale Score	Pre-	26	99.0000	24.4801		
	Post-	26	103.2692	23.9441		
	Gains		4.2692	10.9199	1.9935	.10
Full Scale I.Q.	Pre-	26	99.3846	17.6002		
	Post-	26	102.2692	17.0589		
	Gains		2.8846	7.9465	1.8510	.10

* Pre-test score subtracted from post-test score
** Level of significance on two-tailed test

Statistics on the Slingerland Pre-Reading Screening Procedures

Table XVI, page 108, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Slingerland Pre-Reading Screening Procedures. Inspection of this table indicates highly significant gains in the following categories:

Discrimination-Memory
Auditory Discrimination
Reversals
Inversions
Total Errors

Significant gains were also made on the auditory test. Nonsignificant gains in either a positive or negative direction were indicated in the 8 remaining categories.

TABLE XVI

Mean Pre-test, Post-test, and Gains Score of Preschool Control Group on the Slingerland Pre-Reading Screening Procedures
(1973-1974)

Category		N	Mean	S.D.	"t"	Level of Sig.**
Letter Discrimination	Pre-	26	3.6538	1.5477		
	Post-	26	2.8461	2.5564		
	*Gains		.8076	2.4334	1.6924	N.S.
Word Discrimination	Pre-	26	4.7307	1.6627		
	Post-	26	4.3076	1.5942		
	Gains		.4230	1.2384	1.7418	.10
Discrimination -Memory	Pre-	26	5.2692	1.9299		
	Post-	26	3.6153	2.0990		
	Gains		1.6538	2.4485	3.4440	.01
Copying	Pre-	26	5.3461	1.4125		
	Post-	26	5.2307	2.1034		
	Gains		.1153	1.7961	.3275	N.S.
Copying-Memory	Pre-	26	8.1538	2.6335		
	Post-	26	8.6923	2.7823		
	Gains		- .5384	2.8032	.9794	N.S.
Auditory Discrimination	Pre-	26	3.8076	1.7209		
	Post-	26	2.1923	1.9187		
	Gains		1.6153	2.6088	3.1572	.01
Letter Knowledge	Pre-	26	9.7692	4.2266		
	Post-	26	8.2307	4.6588		
	Gains		1.5384	4.2164	1.8604	.10
Reversals	Pre-	26	6.2692	3.1312		
	Post-	26	4.1538	2.1668		
	Gains		2.1153	3.8086	2.8320	.01
Transpositions	Pre-	26	2.7307	1.4299		
	Post-	26	3.6538	2.1714		
	Gains		- .9230	2.3819	1.9759	.10
Inversions	Pre-	26	4.4230	2.8167		
	Post-	26	2.8076	1.6252		
	Gains		1.6153	2.7287	3.0185	.01

* Post-test error score subtracted from Pre-test error score
** Level of significance on two-tailed test

TABLE XVI (Continued)

Mean Pre-test, Post-test, and Gains Scores of Preschool
Control Group on the Slingerland Pre-Reading
Screening Procedures
(1973-1974)

Category		N	Mean	S.D.	"t"	Level of Sig.**
Rotations	Pre-	26	1.1538	1.7364		
	Post-	26	1.2692	1.6138		
	*Gains		- .1153	2.2685	.2593	N.S.
Substitutions	Pre-	26	23.1153	10.2267		
	Post-	26	21.9615	10.6863		
	Gains		1.1538	8.9696	.6559	N.S.
Total Errors	Pre-	26	40.6153	9.4406		
	Post-	26	35.2307	13.3904		
	Gains		5.3846	9.7039	2.8298	.01
Auditory Test (Number Right)	Pre-	23	15.4782	5.6397		
	Post-	23	17.7391	4.8262		
	Gains		2.6208	4.2127	2.5738	.05
Auditory Test (Number Wrong)	Pre-	23	7.9565	5.0405		
	Post-	23	5.7391	4.1910		
	Gains		2.2173	4.1990	2.5325	.05

* Post-test error score subtracted from Pre-test error score
** Level of significance on two-tailed test

Statistics on the Frostig Developmental Test of Visual Perception

Table XVII, page111, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Frostig Developmental Test of Visual Perception. Inspection of Table XVII reveals significant gains in the area of form constancy and in the perceptual quotient. There was negative gain in the area of spatial relations but not to the level of significance.

TABLE XVII

Mean Pre-test, Post-test, and Gains Scores of Preschool Control Group on the Frostig Developmental Test of Visual Perception (1973-1974)

Category		N	(Scaled Score) Mean	S.D.	"t"	Level of Sig.
Eye-Motor Coordination	Pre-	24	8.8333	1.9034		
	Post-	24	9.1250	1.8252		
	Gains		.2916	1.9886	.7185	N.S.
Figure-Ground	Pre-	24	9.0000	2.1264		
	Post-	24	9.4166	2.5693		
	Gains		.4166	1.9981	1.0215	N.S.
Form Constancy	Pre-	24	10.7083	3.7472		
	Post-	24	12.7500	2.6905		
	Gains		2.0416	3.2097	3.1161	.01
Position in Space	Pre-	2[illegible]	9.7083	2.2932		
	Post-	24	9.0833	1.6396		
	Gains		- .6250	2.2421	1.3656	N.S.
Spatial Relations	Pre-	24	9.5833	1.0598		
	Post-	24	10.1250	1.7769		
	Gains		.5416	1.7932	1.4798	N.S.
Total	Pre-	24	47.8333	7.9873		
	Post-	24	50.4583	8.2038		
	Gains		2.6250	6.5129	1.9745	.10
Perceptual Quotient	Pre-	24	96.1666	16.7945		
	Post-	24	102.5000	15.0881		
	Gains		6.3333	13.1435	2.3606	.05

* Pre-test score subtracted from Post-test score
** Level of significance on two-tailed test

Statistics on the Test of Motor Tasks

Table XVIII, page 113, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Test of Motor Tasks. Inspection of this table reveals highly significant gains in only hopping on the right foot and hopping on the left foot. Gains scores on all other tasks were nonsignificant.

TABLE XVIII

Mean Pre-test, Post-test and Gains Scores of Preschool Control Group on Motor Tasks (1973-1974)

Test		N	Mean	S.D.	"t"	Level of Sig.**
Balance Beam Forwards	Pre-	24	2.8145	.8532		
	Post-	24	2.9610	.7431		
	*Gains		.1465	.6367	1.1272	N.S.
Balance Beam Backwards	Pre-	24	2.3874	.6187		
	Post-	24	2.4381	.5520		
	Gains		.0506	.6086	.4078	N.S.
Balance Beam Sideways	Pre-	24	2.5374	.8153		
	Post	24	2.4201	.8273		
	Gains		- .1173	.7204	.7981	N.S.
Jumping Rope	Pre-	24	2.1541	.6930		
	Post-	24	2.4965	.9480		
	Gains		.3423	1.0512	1.5953	N.S.
Skipping	Pre-	24	1.7784	1.1728		
	Post-	24	2.1145	1.2498		
	Gains		.3361	1.1180	1.4727	N.S.
Hopping Right Foot	Pre-	24	2.5124	1.0547		
	Post-	24	2.9944	.8987		
	Gains		.4819	.7917	2.9820	.01
Hopping Left Foot	Pre-	24	2.2159	1.1191		
	Post-	24	2.7547	.9461		
	Gains		.5388	.9337	2.8272	.01
Hopping Alternate Feet	Pre-	24	1.6791	.9031		
	Post-	24	2.0048	1.0020		
	Gains		.3256	.9826	1.6236	N.S.
Bouncing Ball Right Hand	Pre-	24	2.0867	.7375		
	Post-	24	2.4631	.7495		
	Gains		.3763	.9452	1.9507	.10
Bouncing Ball Left Hand	Pre-	24	1.8854	.9368		
	Post-	24	2.1680	.6018		
	Gains		.2826	.7928	1.7462	.10
Bouncing Ball Both Hands	Pre-	24	1.9013	.7869		
	Post-	24	2.1326	.7518		
	Gains		.2312	.6682	1.6952	N.S.
Throwing and Catching	Pre-	24	3.3284	.9046		
	Post-	24	3.5249	.5123		
	Gains		.1965	.9410	1.0230	N.S.

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* Pre-test score subtracted from Post-test score

** Level of significance on two-tailed test

Intergroup Comparison of Extent of Remediation

It was hypothesized that the experimental and control groups would be significantly differentiated at the close of the experiment in certain aspects of intellectual functioning, perceptual ability, and motor skills and that the experimental group would be significantly more affected in these areas than would the control group.

Statistics on the Wechsler Preschool and Primary Scale of Intelligence

Table XIX, page 115, presents the intergroup differences with respect to mean gains scores on the Wechsler Preschool and Primary Scale of Intelligence. Examination of Table XIX reveals that the experimental group trained with special methods of remediation made a larger gain than the control group to a statistically significant level on the following subtests: comprehension, animal house, mazes, and geometric design. The experimental group made larger gains than the control group on the subtests of information, arithmetic, similarities, picture completion, and block design. The gains of the experimental group over the control group closely approached statistical significance on the verbal score and the verbal I.Q. Finally, the experimental group made highly significant gains over the control group on the performance score, the performance I.Q., the full scale score, and the full scale I.Q. On the vocabulary subtest only, did the gains favor the control group but not to a statistically significant level.

TABLE XIX

Preschool Intergroup Differences of Mean Gains Scores on the Wechsler Preschool and Primary Scale of Intelligence (1973-1974)

Test	Mean E-C*	"t"	Level of Significance**
Information	.5879	1.0360	N.S.
Vocabulary	- .1253	.2850	N.S.
Arithmetic	.9527	1.5908	N.S.
Similarities	.5362	.6432	N.S.
Comprehension	1.4198	2.0032	.05
Verbal Score	3.5000	1.8738	.10
Verbal I.Q.	4.2362	1.7501	.10
Animal House	2.0033	3.1598	.01
Picture Completion	1.1132	1.4967	N.S.
Mazes	2.8428	3.0699	.01
Geometric Design	1.7703	2.2809	.05
Block Design	1.1484	1.6765	.10
Performance Score	7.5450	3.9083	.001
Performance I.Q.	10.8308	4.2706	.001
Full Scale Score	11.0450	3.6438	.001
Full Scale I.Q.	8.1439	3.7300	.001

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Statistics on the Slingerland Pre-Reading Screening Procedures

Table XX, page 117, presents the intergroup differences with respect to the mean gains scores on the Slingerland Pre-Reading Screening Procedures. Examination of Table XX reveals that the experimental group made larger gains than the control group to a statistically significant level in the categories of letter discrimination, word discrimination, copying, copying-memory, transpositions, substitutions, and total errors. The gains of the experimental group over the control group closely approached statistical significance in the categories of discrimination-memory, letter knowledge, inversions, and rotations. Gains favored the control group over the experimental group, but to a statistically non-significant level, in the following categories: auditory discrimination, transpositions, auditory test (number right) and auditory test (number wrong).

TABLE XX

Preschool Intergroup Differences of Mean Gains Scores on the Slingerland Pre-Reading Screening Procedures (1973-1974)

Category	Mean E-C*	"t"	Level of Significance **
Letter Discrimination	.9638	2.0206	.05
Word Discrimination	1.0341	2.3596	.05
Discrimination-Memory	.7176	1.2208	N.S.
Copying	1.5989	3.7524	.001
Copying-Memory	2.6241	4.1424	.001
Auditory Discrimination	- .5010	.7436	N.S.
Letter Knowledge	1.3473	1.5216	N.S.
Reversals	-1.0582	1.2215	N.S.
Transpositions	2.3801	3.9816	.001
Inversions	.3296	.1390	N.S.
Rotations	.0296	.0564	N.S.
Substitutions	5.5891	2.5732	.05
Total Errors	7.9011	3.6052	.001
Auditory Test (Number Right)	- .0884	.0639	N.S.
Auditory Test (Number Wrong)	- .1139	.0963	N.S.

* Mean gains scores of Control Group subtracted from same scores of the Experimental Group

** Level of significance on two-tailed test

Statistics on the Frostig Developmental Test of Visual Perception

Table XXI, page 119, presents the intergroup differences with respect to the mean gains scores on the Frostig Developmental Test of Visual Perception. Examination of Table XXI reveals that the experimental group made larger gains than the control group to a statistically significant level in the areas of figure-ground perception, the total scaled score; and the perceptual quotient. The experimental group made larger, but statistically nonsignificant gains over the control group in the areas of eye-motor coordination, form constancy, and position in space. Gains favored the control group over the experimental group but to a statistically nonsignificant level in the area of spatial relations.

TABLE XXI

Preschool Intergroup Differences of Mean Gains Scores on the Frostig Developmental Test of Visual Perception (1973-1974)

Test	Mean E-C*	"t"	Level of Significance**
Eye-Motor Coordination	.6798	1.3117	N.S.
Figure-Ground	1.3834	2.3325	.05
Form Constancy	1.7012	1.9500	.10
Position in Space	.9678	1.4622	N.S.
Spatial Relations	- .5987	1.6276	N.S.
Total Scaled Score	4.0892	2.4521	.05
Perceptual Quotient	9.2381	2.5172	.05

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Statistics on the Test of Motor Tasks

Table XXII, page 121, presents the intergroup differences with respect to mean gains scores on the Test of Motor Tasks. Examination of Table XXII reveals that the experimental group made statistically significant greater gains than the control group on all tasks except those of skipping, hopping on the right foot, and hopping on alternate feet. The gains here, however, were in favor of the experimental group and closely approached significance.

TABLE XXII

Preschool Intergroup Differences of Mean Gains Scores on Motor Tasks (1973-1974)

Task	Mean E-C*	"t"	Level of Significance**
Balance Beam Forwards	1.0220	4.1047	.001
Balance Beam Backwards	1.2805	7.3433	.001
Balance Beam Sideways	1.3751	6.7114	.001
Jumping Rope	1.3110	5.1060	.001
Skipping	.4615	1.4331	N.S.
Hopping (Right Foot)	.4740	1.8080	.10
Hopping (Left Foot)	.6349	2.5849	.05
Hopping (Alternate Feet)	.5041	1.9377	.10
Bouncing Ball (Right Hand)	.6006	2.3210	.05
Bouncing Ball (Left Hand)	.8281	3.7700	.001
Bouncing Ball (Both Hands)	.7783	3.7180	.001
Throwing and Catching	.8344	2.8371	.01

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Summary

The intergroup differences are conveniently summarized in Table XXIII, page 123 , Table XXIV, page 124 , and Table XXV, page 125. On the basis of the total data concerning the experimental group and the control group as well as the intergroup comparisons the following observations may be made:

1. Out of 50 possible test scores the experimental group made 48 positive gains, 45 of which were significant. One score was a significant negative gain, and 1 score was a nonsignificant negative gain.
2. Out of 50 possible test scores the control group made 43 positive gains, 13 of which were significant. Seven were nonsignificant negative gains.
3. An intergroup comparison showed the experimental group with 44 positive gains over the control group, 27 of which were significant. Six scores were nonsignificant negative gains.

TABLE XXIII

Summary of Test Gains Favoring the Experimental Group with Significant Intergroup Differences (1973-1974)

Test	Level of Significance
Wechsler Preschool and Primary Scale of Intelligence	
Comprehension	.05
Verbal Score	.10*
Verbal I.Q.	.10*
Animal House	.01
Mazes	.01
Geometric Design	.05
Block Design	.10*
Performance Score	.001
Performance I.Q.	.001
Full Scale Score	.001
Full Scale I.Q.	.001
Slingerland Pre-Reading Screening Procedures	
Letter Discrimination	.05
Word Discrimination	.05
Copying	.001
Copying-Memory	.001
Transpositions	.001
Substitutions	.05
Total Errors	.001
Frostig Developmental Test of Visual Perception	
Figure-Ground	.05
Form Constancy	.10*
Total Scaled Score	.05
Perceptual Quotient	.05
Motor Tasks Test	
Balance Beam (Forwards)	.001
Balance Beam (Backwards)	.001
Balance Beam (Sideways)	.001
Jumping Rope	.001
Hopping (Right Foot)	.10*
Hopping (Left Foot)	.05
Hopping (Alternate Feet)	.10*
Bouncing Ball (Right Hand)	.05
Bouncing Ball (Left Hand)	.001
Bouncing Ball (Both Hands)	.001
Throwing and Catching	.01

* Approaching but less than significance

TABLE XXIV

Summary of Test Gains Favoring the Experimental Group with Nonsignificant Intergroup Differences

(1973-1974)

Test	Level of Significance
Wechsler Preschool and Primary Scale of Intelligence	
Information	N.S.
Arithmetic	N.S.
Similarities	N.S.
Verbal Score	.10*
Verbal I.Q.	.10*
Picture Completion	N.S.
Block Design	.10*
Slingerland Pre-Reading Screening Procedures	
Discrimination-Memory	N.S.
Letter Knowledge	N.S.
Inversions	N.S.
Rotations	N.S.
Frostig Developmental Test of Visual Perception	
Eye-Motor Coordination	N.S.
Form Constancy	.10
Position in Space	N.S.
Motor Tasks Test	
Skipping	N.S.
Hopping (Right Foot)	.10*
Hopping (Alternate Feet)	.10*

* Approaching but less than significance

TABLE XXV

Summary of Test Gains Favoring the Control Group with Nonsignificant Intergroup Differences

(1973-1974)

Test	Level of Significance
Wechsler Preschool and Primary Scale of Intelligence	
Vocabulary	N.S.
Slingerland Pre-Reading Screening Procedures	
Auditory Discrimination	N.S.
Reversals	N.S.
Auditory Test (Number Right)	N.S.
Auditory Test (Number Wrong)	N.S.
Frostig Developmental Test of Visual Perception	
Spatial Relations	N.S.

Conclusions

The following conclusions are drawn from the statistical analysis of the data:

1. The methods of remediation employed in the research enabled the pupils exposed to this training to gain significantly over pupils in a control group in the following areas of the Wechsler Pre-School and Primary Scale of Intelligence: Comprehension, Animal House, Mazes, Geometric Design, Performance Score, Performance I.Q., Full Scale Score and Full Scale I.Q..
2. The method of remediation employed in the research enabled the pupils exposed to this training to gain significantly over pupils in a control group in Letter Discrimination, Word Discrimination, Copying, Copying-Memory, as well as the Reduction of Transpositions, Substitutions and Total Errors as measured by the Slingerland Pre-Reading Screening Procedures.
3. The method of remediation employed in the research enabled the pupils exposed to this training to gain significantly over a control group in Perception of Figure-Ground as well as in the Total Scaled Score and the Perceptual Quotient, as measured by the Frostig Developmental Test of Visual Perception.
4. The method of remediation employed in the research enabled the pupils exposed to this training to gain significantly over a control group in equilibrium as indicated by performance on the balance beam forwards,

backwards and sideways, and in the motor tasks of jumping rope, hopping (left foot), bouncing a ball with the right hand, left hand, and both hands as well as in throwing and catching.

5. Remediation methods enabled pupils to gain, but not significantly, over pupils in a control group in the following areas of the Wechsler Pre-School and Primary Scale of Intelligence: Information, Arithmetic, Similarities, Verbal Score, Verbal I.Q., Picture Completion, and Block Design.
6. Remediation methods allowed pupils to gain, but not significantly, over pupils in a control group in Discrimination-Memory, and Letter Knowledge as well as in Reduction of Inversions and Rotations, as measured by the Slingerland Pre-Reading Screening Procedures.
7. Remediation methods allowed pupils to gain, but not significantly, over pupils in a control group in Eye-Motor Coordination, Perception of Form Constancy and in Perception of Position in Space as measured by the Frostig Developmental Test of Visual Perception.
8. Remediation methods enabled pupils to gain, but not significantly, over a control group in the motor tasks of skipping, hopping (right foot), and hopping (alternate feet).

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Appendix A

EXPERIMENTAL LEARNING PROGRAM
for Preschool Children in
the Model Cities Area

For over-active children who have
difficulty paying attention

For information call:

724-8441 (9:00 a.m. — 12:00 noon)
782-3860 (afternoons, evenings and
weekends)

Leland Bechtel, Project Director

Appendix B

TO: Radio Stations WPNO, WCOU, AND WLAM

FROM: Leland Bechtel, Project Director
Learning Center
Park Hill Avenue,
Auburn, Maine

Please make the following free public service announcement during the month of August.

Special Preschool Program for Model Cities Children

If you have a normally bright 4 or 5-year-old child who just can't sit still or pay attention, who seems to get into more than his share of trouble, yet who seems to try so very hard; you might want to have him considered for the federally supported Experimental Learning Program.

At no expense to you, a kind sympathetic, highly qualified staff will train your child by means of some of the most advanced techniques employed in education. When he enters school, your child will receive special tutorial help and attention, and his progress will be carefully followed by a professional staff.

This program for 4 and 5-year-old children will run from this September to next April with sessions being held at the Learning Center, Park Hill Avenue, Auburn, Maine.

For information call: 784-8441 (9:00-12:00)

Appendix C

SPECIAL PRESCHOOL PROGRAM

FOR MODEL CITIES CHILDREN
(4-5 Year-olds)

Thirty four and five year old Model Cities children will be selected for this federally supported experimental program that will run from September, 1971 to April, 1972. This program is especially designed for highly active, normally bright children.

We will give your child these unusual advantages:

1) We will discover how your child learns best by making use of special educational tests and trained individualized observation.

2) Then, we will train your child by means of some of the most advanced techniques yet employed in education.

3) When your child enters school, we will provide a specially trained tutor for him teaching him by means of methods that we have discovered work well with him.

4) We will be in conference with your child's regular school teachers sharing our learning discoveries so that your child's maximum progress will continue throughout the school year.

5) We will share all our information with you, his parents, so that you may be able to best help him at home.

To have your child considered for this program call:

784-8441 (Daytime)

782-3860 (Evenings and Weekends)

THE LEARNING DISABILITY PROGRAM
ANDROSCOGGIN COUNTY TASK FORCE ON SOCIAL WELFARE, INC.
Park Hill Avenue
Auburn, Maine

Project Director -- Leland P. Bechtel, PhD.
Assistant Project Director -- David R. Magnussen, B.A.

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Appendix D

P-M TASKS

S # ____________ Test (Pre- or Post-) ____

Rater ____________ Date ____________

	Excellent 5	Good 4	Fair 3	Poor 2	Cannot Perform Task 1
1) Jumping Rope	o______	o______	o______	o______	o______
2) Bouncing Ball					
Right Hand	o______	o______	o______	o______	o______
Left Hand	o______	o______	o______	o______	o______
Both Hands	o______	o______	o______	o______	o______
3) Throwing and Catching Ball	o______	o______	o______	o______	o______
4) Balance Beam					
Forwards	o______	o______	o______	o______	o______
Backwards	o______	o______	o______	o______	o______
Sideways	o______	o______	o______	o______	o______
5) Skipping	o______	o______	o______	o______	o______
6) Hopping					
Right Foot	o______	o______	o______	o______	o______
Left Foot	o______	o______	o______	o______	o______
	5 Excellent	4 Good	3 Fair	2 Poor	1 Cannot Perform Task

PART II ELEMENTARY SCHOOL PROGRAM

CHAPTER I

THE PROBLEM

The Statement of the Problem

This research evaluated the effects of methods of remediation of learning disabilities in elementary school children upon perceptual-motor ability, certain aspects of intellectual functioning, and performance in specified areas of learning.

Basic Hypothesis

It was hypothesized that an experimental group of elementary school children, diagnosed as perceptually disabled (dyslexic) on the basis of careful screening procedures and subjected to intense remediation procedures in a six-week summer program and a control group similarly diagnosed as perceptually disabled would be significantly differentiated at the close of the experiment in perceptual-motor ability, certain aspects of intellectual functioning and specified areas of learning and that the experimental group would be significantly more affected in these areas than would the control group.

The Need for the Study

The salient features of the whole dyslexic problem have been described in Part I under this same heading. While the prognosis for early detection and remediation has been generally favorable, the success of remediation attempts has diminished sharply with increasing age. Due to the large numbers of perceptually impaired children who constantly suffer academic failure and consequently grow deeply discouraged and often hostile, means must be found to reconstruct the perceptual, integrative and response systems of these children and put them on the road to academic progress. This research is aimed at testing the effectiveness of remediation procedures with those children who are already painfully frustrated and deeply discouraged.

By and large, the only recipients of attempts at remediation have been children of privileged, wealthy families because of the prohibitive costs of low pupil-teacher ratio pioneering rehabilitative programs. This present research is an attempt to test the effects of certain remedial procedures upon the responses of children of elementary school age who face the additional hardships of being culturally disadvantaged.

CHAPTER II

PROCEDURE IN COLLECTING DATA

The Setting

The data for this research was derived mostly from elementary school children residing in the Model Cities vicinity of Lewiston, Maine. The more than 1500 children between the ages of 5 years and 14 years who reside in the Model Cities area provided the pool of children from which 40 subjects with pronounced dyslexic tendencies were selected. The primary means of locating children for initial screening was through referrals from the elementary school principals of the five schools in the area. The teachers of these schools have become sufficiently well informed to recognize cases of perceptual disablement with a high degree of accuracy. Through observational visits to the summer program of the previous year, through teacher workshops featuring speakers on learning disabilities (including the director of this present project), and through growing information programs on both local and national levels, teachers have become far more sensitive to the needs of dyslexic children than ever before. Further publicity was gained through newspaper ads, public service announcements on the three local radio stations, and mimeographed flyers distributed through the city Health nurses, the Model Cities Office, and low income meeting places.

The remedial training program was conducted at the Pettengill Elementary School, Lewiston, Maine, made available by the unusually helpful Superintendent of Schools. This well-equipped, spacious school with a gymnasium and other athletic facilities was adequate for the needs of the program. The constant assistance of the school principal, the provision of janitorial personnel, and the cooperative nature of the secretarial personnel facilitated the effective operation of the program. The space utilization was as follows:

Tutorial rooms
Math class room
English composition room
Perceptual-motor training room
Gross motor training room
Outside play area
Dining area
Kitchen
Office

Research Populations

Forty elementary school children with an average age of 10.29 years were selected on the basis of extensive diagnostic screening as sufficiently perceptually disabled for inclusion in the remedial program. It was seldom possible to have N = 40 for any one test because of the difficulty of testing many of these children. Their initial uncooperativeness, their inability to attend in a sustained manner, and their unwillingness or inability to follow directions made the acquisition of data very difficult. However, in every case wherein data could be obtained the data was included in this analysis.

Materials and Evaluative Devices

The following evaluative devices were used as indicated:

Wechsler Intelligence Scale for Children	(Initial Screening)
Slingerland Screening Tests for Identifying Children with Specific Language Disability	(Initial Screening plus pre- and post-testing)
Frostig Developmental Test of Visual Perception	(Initial Screening plus pre- and post-testing)
Metropolitan Reading Tests	(Pre- and post-testing)
Metropolitan Arithmetic Test	(Pre- and post-testing)
Gilmore Oral Reading Test	(Pre- and post-testing)
Test of Motor Tasks	(Pre- and post-testing)

The above tests were administered by three trained testers in conjunction with consultants who assisted in the analysis of test data and advised in test interpretation. The decision to enroll a child in the program was made by project director following a diagnostic council meeting wherein data from the tests administered the previous day was presented and carefully analyzed.

Testing for screening purposes was done at the Learning Center beginning on the first Saturday in May and continuing on Saturdays until mid-June. Following the end of the school term testing was done 5 days weekly through the first week in July. Screening was accomplished in approximately 4 full weeks of work.

Wechsler Intelligence Scale for Children

The WISC is a distinct test from the Wechsler Adult Intelligence Scale and is preferred in testing adolescents up through the age of 15 years. This test yields a deviation I.Q. which is based on a comparison of each subject's test performance with the scores earned by individuals in his age group. An I.Q. of 100 is set equal to the mean total score for each age, and the standard deviation is set equal to 15 points. The WISC consists of 12 subtests divided into two equal subgroups identified as Verbal and Performance. The reliability coefficients computed by the split-half technique for children aged 10½ years are as follows: Verbal Score, .96; Performance Score, .89; and Full Scale Score, .95.

This test was used to assess the general intellectual level of the child to determine if he qualified intellectually for admission to the program, and it was used diagnostically as an indicator of dyslexic symptoms on the basis of certain typical patterns of response.

Slingerland Screening Tests for Identifying Children with Specific Language Disability

This test was administered individually to each child to discover weaknesses in visual, auditory, and kinesthetic functioning. The authors indicate that "the purpose of the Screening Tests is to screen from among a group of children those with potential language difficulties and those with already present specific language disabilities who are in need of special attention at the moment."[1] These tests appear in three sets continuing to the 4th grade but may be used with individuals beyond the given grade levels. The author indicates that ". . . they may be used for comparative purposes to measure gains after remediation."[2]

Frostig Developmental Test of Visual Perception

This test is described in Part I of this report under the same heading.

Metropolitan Reading Tests

The authors describe the purpose of this test as ". . . to afford dependable data concerning the level of pupil achievement in word knowledge and reading."[3] This test was administered to pupils in small groups. Scoring was in terms of raw scores, standard scores, stanines, grade equivalents, and percentile rank. The tabular presentations in this report contain raw scores. The authors indicate that an important use of the test is ". . . to compare present achievement with past achievement in order to determine and evaluate progress."[4]

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[1] Slingerland, Beth. Teacher's Manual to Accompany Slingerland Screening Tests for Identifying Children with Specific Language Disability. Cambridge: Educators Publishing Service, Inc., 1970, p. xx.

[2] Ibid., p. 3.

[3] Directions for Administering Metropolitan Achievement Tests. Walter N. Durost, Editor. New York: Harcourt, Brace and World, Inc., 1959, p. 7.

[4] Ibid., p. 3.

Metropolitan Arithmetic Test

This test presents data concerning the level of achievement in arithmetic computation and arithmetic problem solving and concepts. This test was administered to pupils in small groups. Scoring was in terms of raw scores, standard scores, stanines, and grade equivalents. The tabular presentations in this report are in terms of raw scores. The reliability coefficient of the arithmetic computation subtest is .92 and of the arithmetic problem solving and concepts subtest is .88.

Gilmore Oral Reading Test

This individually administered test provides measures of accuracy of oral reading, comprehension of material read, and rate of reading. It has two equivalent forms, C and D and has levels for pupils in grades 1 through 8. Each form presents 10 oral reading paragraphs which form a continuous story with illustrations of characters and events in the paragraphs, and five comprehension questions for each paragraph. For purposes of this research trained testers recorded each pupil's responses on cassette tape and scored the test from the recording. Thus accuracy of scoring as well as permanence of record could be assured. Alternate forms were administered pre- and post-. The test is interpreted in terms of raw scores, stanines, grade equivalents and ratings. The tabular presentations of this report are in terms of raw scores.

Test of Motor Tasks[1]

This test required the performance of the following physical tasks which were rated by the tester on a 5-point scale: balance beam forwards, backwards, and sideways; balance board; skipping; and hopping. The ocular pursuits of tracking and convergence were rated on a 3-point scale. Dominance tests were also given for diagnostic purposes but not included in the assessment of progress.

Methods of Remediation

The staff consisted of the following members:

1	Project director
1	Assistant project director (part-time)
1	Parent education specialist
1	Perceptual-motor specialist
2	Gross motor specialists
2	Teaching aides
13	Reading tutors
1	English composition teacher
1	Math teacher (part-time)
1	Secretary (part-time)
1	Cook (part-time)
1	Cook-aide (part-time)
4	Drivers (part-time)
2	Aides from the Neighborhood Youth Corps

The staff was selected on the basis of experience and effectiveness with this age group of children. One week of training preceded the 6 week program at which time outside consultants were employed to instruct the staff. Most of the reading tutors had prior tutorial experience plus well-developed theoretical understandings through a course on learning disabilities offered at Bates College. During the operation of the program, staff meetings were held at the close of each day not only to deal with the material aspects of the program but to discuss the needs of individual children and to plan an integrated approach to the problems of each child.

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[1] See Appendix A.

The program was organized according to the following schedule from Monday to Thursday:

9:00 - 9:50	1st period
9:50 - 10:40	2nd period
10:40 - 10:55	Snack
10:55 - 11:45	3rd period
11:45 - 12:15	Lunch
12:15 - 1:05	4th period
1:05 - 1:55	5th period
1:55 - 2:10	Snack
2:10 - 3:00	6th period

Fridays were used for outings which provided relaxation through swimming and an opportunity for tutors and other staff members to establish friendly relationships with pupils on other than an academic basis.

Each child's schedule was arranged so that he had 1 period of individual tutoring in reading in the morning and 1 period of individual tutoring in reading in the afternoon. In addition, there was 1 period of perceptual-motor training, 1 period of gross motor training, 1 period of English composition, and 1 period of math daily.

The individualized tutoring sessions provided instruction in reading skills with primary emphasis upon linguistic and phonic approaches. The Bloomfield-Barnhart Let's Read Series with the accompanying Let's Look workbook were utilized to enable the pupil to learn words by families. The phonic approach of Schoolfield and Timberlake employing a consonant and vowel chart with illustrations of their sounds was used to enable the pupil to learn the sounds of the letters and to practice blending them until recognition of new words could be achieved. The tutors operated within the framework of the principles of remedial instruction for dyslexia set forth by N. Dale Bryant.[1]

Remediation initially focused on the simplest, most basic perceptual-associational elements in reading. Responses were overlearned until they were automatic. The tutor endeavored to plan the learning experience so that the child was correct in nearly all of his responses. Systematic elimination of interference between discriminations and associations were undertaken in graduated steps. Finally, the tutor utilized frequent reviews of basic perceptual, associational, and blending skills involving actual reading.

The relationship between the child and the tutor was a sensitive one. Interest, acceptance, and approval were essential to the child's progress in learning. It was the task of the tutor to analyze the child's needs and to structure the learning situation so that the child would have his first experiences of success.

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[1] Bryant, N. Dale, "Some Principles of Remedial Instruction for Dyslexia," The Reading Teacher, April, 1965, pp. 567-572.

The perceptual-motor training was directed by a highly experienced teacher who had taught on levels ranging from K to 12 and was experienced in teaching dyslexic children. She was assisted by a younger teacher's aide. The curriculum included visual, auditory, and motor coordination activities. Visual-tracking eye exercises were daily provided for children diagnosed as lacking smooth control. Auditory discrimination phonograph records were employed to cultivate attending to specific auditory stimuli. A rotating pegboard was used to develop fine muscle coordination and an integrator was used to develop sequencing skill. In addition, drawing activities, games involving counting, and puzzles involving figure-ground perception were utilized. The activities participated in here were always presented within the context of play and were constantly being augmented with new additions. Intense interaction of the teacher and her aide with the pupils was constantly maintained. The teachers participated with the children in everything. The aim here was to enable the child to focus and attend to specific visual and auditory stimuli, to establish eye-muscle coordination, to achieve unity of dominance, and generally to develop fine muscle control.

The gross motor training was aimed at developing performances utilizing the large muscle groups which may serve as the foundation for fine muscle coordination such as handwriting. Throwing and catching a basketball, shooting baskets, skipping and balancing were employed. Rhythmic motor activities such as skipping rope, dancing, and the performance of gymnastics were stressed. Finally, techniques of relaxation were regularly utilized to reduce neuromuscular tension.

English composition class was conducted by a highly skilled male teacher having a record of unusual success with disadvantaged children. He encouraged the telling of stories out of everyday city life, illustrating these experiences with pictures and simple drawings, and then putting the narrative into written form that would be bound along with the pictures into the form of a small book. He steadily cultivated in pupils the ability to compose themes and essays by the progressive development of grammatical construction in linguistic expression. Development of handwriting skills using the materials of Gillingham, Stillman, Drake, and others was attempted through carefully planned writing assignments. Exposure of the children to a rich supply of children's literature fostered an interest that led to many of them acquiring public library cards. The children were given access to typewriters and provided with enough instruction to type short themes which they composed. Constant praise and display of the children's work in prominent places in the building heightened motivation. No matter on what level of performance, if a child achieved anything that was a step up, the teacher often would rush to the director or some other adult excitedly showing the child's work, frequently within the observation of the child. Many of these pupils probably had not received praise for academic work within their immediate recollection. The teacher imparted a contagion of enthusiasm regarding English composition.

Arithmetic was taught by a male college student who had demonstrated singular effectiveness teaching arithmetic in this program the previous summer. His low-keyed, gentle, but firm manner combined with his brilliant record as a college athlete to make him an inspiring identification figure for pupils in the program. The primary text utilized was the Elementary School Mathematics, series K-6 by Eicholy, et al. (Addison-Wesley Publishing Company, Inc., 1968). Flash cards, multiplication tables, worksheets, and recitation were utilized. The teacher had mastered the art of maintaining constant verbal contact with each child in his class (never more than 7 children) always recognizing each remark with a constructive response. His class was a virtual dynamic unit of intercommunication from beginning to end. Stray comments were always recognized but redirected to the subject matter at hand without scolding, recrimination, or any element of negativism. He encouraged discovery and understanding of ideas working in drill frequently but for limited periods of time.

CHAPTER III

RESULTS: TREATMENT AND INTERPRETATION OF DATA (1972)

Statistics Indicating Comparability of Groups

The assumption that both groups were comparable with regard to sex and age is supported by the data indicated in Table I, page 144. The difference in the composition of the groups in regard to sex is only 4 per cent. The ranges, means and standard deviations of age are closely comparable. The F and "t" ratios indicate no significant difference between the groups in age.

TABLE I

Description and Comparison of the Experimental and Control Groups with Regard to Sex and Age
(1972)

	Experimental Group		Control Group	
	Male	Female	Male	Female
N	30	10	15	4
Percentage	75	25	79	21
Age: Mean	9.94	11.07	9.92	10.22
Range	6.75-14.83	7.92-15.17	6.75-12.92	7.67-15.83
Mean	10.50	10.29	10.07	
S.D.	1.986		2.558	
F		1.003		
"t"		0.373*		

*Not significant at .05 level of significance

The similarity of the two groups in terms of sex and intelligence is indicated by Table II, page146, showing Verbal I.Q., Performance I.Q., and Full Scale I.Q., measured on the Wechsler Intelligence Scale for Children. Although direction of differences was in favor of the control group being slightly higher, F and "t" ratios indicate no significant differences between the groups in intelligence.

TABLE II

Description and Comparison of the Experimental and Control Groups with Regard to Sex and Intelligence (1972)

	Experimental Group				Control Group		
	Male		Female		Male		Female
N	30		10		15		4
Verbal I.Q.							
Mean	90.33		79.70		91.67		93.50
Range	72-113		70-96		72-100		70-114
Mean		85.02				92.59	
S.D.		11.004				13.239	
F				1.447			
"t"				1.420*			
Performance I.Q.							
Mean	96.93		87.00		95.20		90.00
Range	67-118		61-111		76-118		69-111
Mean		91.97				92.60	
S.D.		13.945				11.365	
F				1.506			
"t"				0.094*			
Full Scale I.Q.							
Mean	92.83		81.60		92.60		91.25
Range	70-115		62-103		76-107		67-112
Mean		87.23				91.93	
S.D.		12.739				12.680	
F				1.009			
"t"				0.646*			

*Not significant at .05 level of significance

The similarity of the two groups is further shown by comparisons of pre-test scores on the following tests indicated by the respective tables:

Slingerland Screening Tests, Table III, page 148
Frostig Developmental Test of Visual Perception, Table IV, page 149
Metropolitan Reading Tests, Table V, Page 150
Metropolitan Arithmetic Test, Table VI, page 151
Gilmore Oral Reading Test, Table VII, page 152; and
Test of Motor Tasks, Table VIII, page 153

However, since this research is concerned with gains scores, differences between the groups in initial ability would not invalidate a comparison of the groups.

TABLE III

Comparison of Pre-test Scores on the Slingerland Screening Tests for Identifying Children with Specific Language Disability (1972)

Test		N	Mean	Range	S.D.	F
Copying-Chart	E*	32	5.46875	1-25	5.8253	1.7229
	C**	16	4.3125	0-13	4.4379	
Copying-Page	E	32	1.8125	0-10	2.7171	2.2260
	C	16	1.3750	0-7	1.8211	
Visual Perception-Memory	E	32	3.1562	0-6	1.6869	1.1245
	C	16	4.0000	1-8	1.7888	
Visual Discrimination	E	32	2.1875	0-6	3.6061	2.5353
	C	16	3.0625	0-7	2.2647	
Visual Perception-Memory-Kinesthetic	E	32	7.28125	1-14	3.4288	1.1667
	C	16	9.12500	3-15	3.7036	
Auditory Recall	E	32	10.3125	3-27	5.4206	1.4667
	C	16	13.1875	6-27	6.5647	
Auditory Sounds	E	31	6.5000	1-15	4.0347	1.3737
	C	16	6.6875	1-14	4.7289	
Auditory Association	E	31	4.6875	0-10	2.7092	3.9108
	C	16	5.1875	1-13	5.3576	
Total Errors	E	39	49.10256	12-124	23.4773	2.0495
	C	19	45.36842	23-82	16.3782	
Total Errors Plus Self-Corrections and Poor Formations	E	39	74.3333	12-137	27.1441	1.7137
	C	19	51.7894	23-107	20.7350	

*Experimental Group
**Control Group

TABLE IV

Comparison of Pre-test Scores on the Frostig Developmental Test of Visual Perception (1972)

Test		N	Mean	Range	S.D.	F
Eye-Motor Coordination	E*	40	17.775	14-26	3.7449	1.1016
	C**	14	18.7142	13-25	3.9307	
Figure Ground	E	40	17.375	4-20	3.9528	12.0498
	C	14	19.2857	16-20	1.1387	
Form Constancy	E	40	10.800	0-17	3.6247	1.4871
	C	14	11.7142	4-15	2.9724	
Position in Space	E	40	7.400	3-8	1.0328	1.4707
	C	14	7.4285	5-8	0.8516	
Spatial Relations	E	40	6.425	3-8	1.1297	1.0159
	C	14	6.7142	3-8	1.1387	
Total	E	40	59.450	29-74	10.4561	1.1565
	C	16	63.000	41-75	9.7228	

*Experimental Group
**Control Group

TABLE V

Comparison of Pre-test Scores on the Metropolitan Reading Tests
(1972)

Test		N	Mean	Range	S.D.	F
Word Knowledge	E*	34	16.4411	1-42	7.5123	2.7683
	C**	13	21.3076	8-46	12.4992	
Reading	E	34	15.0588	5-34	5.7098	2.1903
	C	13	17.9230	9-35	8.4504	

*Experimental
**Control Group

TABLE VI

Comparison of Pre-test Scores on the Metropolitan Arithmetic Test
(1972)

Test		N	Mean	Range	S.D.	F
Computation	E*	35	15.7428	0-42	11.9517	1.1658
	C**	14	18.7142	0-44	12.9045	
Problem Solving and Concepts	E	28	9.8928	1-33	8.2432	1.7727
	C	12	12.5000	0-32	10.9751	

*Experimental Group
**Control Group

TABLE VII

Comparison of Pre-Test Scores on the Gilmore Oral Reading Test (1972)

Test		N	Mean	Range	S.D.	F
Accuracy	E*	38	10.3157	0-42	8.2235	4.6770
	C**	18	13.9444	4-47	14.4594	
Comprehension	E	38	15.8684	3-29	6.5064	2.9953
	C	18	17.2777	0-40	11.2605	
Rate: Words per Minute	E	37	59.8918	12-120	32.4523	1.5538
	C	14	59.5714	18-138	40.4526	

*Experimental Group
**Control Group

TABLE VIII

Comparison of Pre-Test Scores on Motor Tasks (1972)

Task	N	Mean	Range	S.D.	F
Balance Beam Forwards	E* 38	4.05263	1-5	1.1137	2.2455
	C**15	4.5333	3-5	0.7432	
Balance Beam Backwards	E 38	2.42105	1-4	1.0035	1.2294
	C 15	2.9333	1-5	1.1126	
Balance Beam Sideways	E 38	2.7105	1-5	0.9838	1.0478
	C 15	3.2666	2-5	0.9611	
Balance Board	E 38	3.34210	1-5	1.2579	1.1916
	C 15	3.8000	1-5	1.3732	
Skipping	E 38	4.3157	1-5	1.0680	1.1978
	C 15	4.3333	2-5	0.9759	
Hopping	E 38	4.1578	1-5	0.9733	3.6849
	C 15	4.6000	4-5	0.5070	
Ocular Pursuits Tracking	E 38	2.0526	1-3	0.8988	1.4141
	C 14	2.42857	1-3	0.7559	
Convergence	E 39	2.5789	1-3	0.8583	4.0639
	C 14	2.7857	2-3	0.4257	

*Experimental Group
**Control Group

Statistical Procedure

In order to determine the extent of remediation of learning disability in an experimental group and a control group by evaluating each group prior to the training and after the training for perceptual, motor, arithmetical, and reading skills, the "t" method for assessing the significance of the differences between correlated means of small samples was used. The following steps were taken:

1. The scores for each measure, pre- and post-, were obtained for each S in the group.
2. The difference between pre- and post-scores for each measure was obtained for each S in the group.
3. The means and standard deviations of these means were calculated.

By using the following formula and going into the "t" tables with N-1 degrees of freedom, it was possible to determine whether these differences were significant at the five per cent level of significance:

$$\text{"t"} = \frac{Mdi}{\sqrt{\dfrac{\sum x^2 d}{N(N-1)}}}$$ [1]

Where: Mdi = mean of the N difference of paired observations

xd = deviation of a difference from the mean of the differences.

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[1] Guilford, J.P., Fundamental Statistics in Psychology and Education. New York: McGraw-Hill, 1950, p. 228.

The means and standart deviations of the differences of each measure indicated the extent to which the training objectives were attained and the measure obtained with the "t" formula indicated whether or not these differences were significant at the five per cent level of confidence.

In order to make an intergroup comparison of the aforementioned data obtained from the determination of extent of remediation in the experimental group and the extent of remediation in the control group to ascertain the effect of specialized training upon perceptual, motor, arithmetical and reading skills the F test of homogeneity of variance at the five per cent level was used to satisfy the assumption underlying the "t" test:

$$F = \frac{\text{larger variance}}{\text{smaller variance}} \quad ^{1}$$

$$F = \frac{\dfrac{\sum d_1^2}{N_1 - 1}}{\dfrac{\sum d_2^2}{N_2 - 1}}$$

where: $\sum d^2$ = sum of squares of the sample.

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[1] *Ibid.*, p.232.

Thereupon the "t" method for assessing the significance of the differences between uncorrelated means of small samples was used by treating the aforementioned data according to the following formula:

$$"t" = \frac{M_1 - M_2}{\sqrt{\left(\frac{\sum x_1^2 + \sum x_2^2}{N_1 + N_2 - 2}\right)\left(\frac{N_1 + N_2}{N_1 N_2}\right)}}$$

where M_1 and M_2 are the means in the two samples (here, the means of the differences in the two samples). $\sum x_2^1$ and $\sum x_2^2$ are the sums of the squares of the two samples (deviation of a differences from the means of the differences). N_1 and N_2 are the numbers of observations, respectively. Going into the "t" tables with N + N - 2 degrees of freedom, it was possible to determine whether these differences were significant at the five per cent level.

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[1] *Ibid.*, p. 238.

Extent of Remediation in Experimental Group

The first problem was to determine the extent of remediation in an experimental group, composed of learning disabled elementary school pupils, by evaluating the group prior to the training and after the training period for perceptual, motor, arithmetical and reading skills.

Statistics on Slingerland Screening Tests

Table IX, page 158, presents the mean pre-test, post-test, and gains scores, the standard deviations of these scores, and the "t" ratios of the experimental group on the Slingerland Screening Tests for Identifying Children with Specific Language Disability. Examination of Table IX reveals that highly significant gains were made in the following areas of performance:

Copying - Chart
Copying - Page
Visual Perception - Memory
Visual Discrimination
Auditory Association
Total Errors
Total Errors Plus Self-Corrections and Poor Formations

Two areas of performance failed to show significant gains--Visual Perception-Memory-Kinesthetic where positive gain did not achieve statistical significance and Auditory Recall where there was negative gain (increase in errors) but not to the level of statistical significance.

TABLE IX

Mean Pre-test, Post-test, and Gains Scores of the Experimental Group on the Slingerland Screening Tests for Identifying Children with Specific Language Disability (1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Copying-Chart	Pre-	32	5.46875	5.8253		
	Post-	32	3.000	3.4641		
	*Gains		2.46875	6.525304	2.14127	.05
Copying-Page	Pre-	32	1.8125	2.7171		
	Post-	32	0.7500	1.7780		
	Gains		1.0625	2.263846	2.44879	.05
Visual Perception-Memory	Pre-	32	3.15625	1.6869		
	Post-	32	2.12500	1.8621		
	Gains		1.03125	1.768615	3.29441	.01
Visual Discrimination	Pre-	32	2.18750	3.6061		
	Post-	32	1.18750	1.4241		
	Gains		1.00000	1.481046	3.82238	.002
Visual Perception-Memory-Kinesthetic	Pre-	32	7.28125	3.4288		
	Post-	32	6.5625	3.8170		
	Gains		0.71875	3.603165	1.13037	N.S.
Auditory	Pre-	32	10.31250	5.4206		
	Post-	32	12.28125	7.2344		
	Gains		-1.96875	6.620536	-1.68325	N.S.
Auditory Sounds	Pre-	31	6.50000	4.0347		
	Post-	31	5.28125	4.3653		
	Gains		1.21875	3.235119	2.09937	.05
Auditory Association	Pre-	31	4.68750	2.7092		
	Post-	31	3.84375	2.7626		
	Gains		0.84375	1.893066	2.47052	.02
Total Errors	Pre-	39	49.10256	23.4473		
	Post-	39	42.12821	25.2900		
	Gains		6.97435	15.4723	2.81325	.01
Total Errors Plus Self-Corrections and Poor Formations	Pre-	39	74.33333	27.1441		
	Post-	39	62.05128	15.8466		
	Gains		12.28205	17.414373	4.40375	.002

*Post-test error score subtracted from Pre-test error score
**Level of significance on two-tailed test

Statistics on Frostig Developmental Test of Visual Perception

Table X, page 160, presents the mean pre-test, post-test, and gains scores, the standard deviations of these scores and the "t" ratios in areas of visual perception measured by the 5 Frostig tests. Examination of Table X reveals that positive changes with a high level of significance occurred in eye-motor coordination, figure ground, form constancy, spatial relations and total test performance. Positive change occurred in perception of position in space but this gain falls short of being significant.

TABLE X

Mean Pre-test, Post-test and Gains Scores of the Experimental Group on the Frostig Developmental Test of Visual Perception (1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Eye-Motor Coordination	Pre-	40	17.775	3.7449		
	Post-	40	19.250	3.3645		
	*Gains		1.475	2.561913	3.65363	.002
Figure Ground	Pre-	40	17.375	3.9528		
	Post-	40	18.400	3.3497		
	Gains		1.025	1.860349	3.50164	.002
Form Constancy	Pre-	40	10.800	3.6247		
	Post-	40	14.075	2.6639		
	Gains		3.275	3.145917	6.59411	.002
Position in Space	Pre-	40	7.400	1.0328		
	Post-	40	7.575	0.8129		
	Gains		0.175	1.114181	1.02174	N.S.
Spatial Relations	Pre-	40	6.425	1.1297		
	Post-	40	6.850	1.4771		
	Gains		0.425	0.984174	2.76327	.01
Total	Pre-	40	59.450	10.4561		
	Post-	40	66.125	13.4829		
	Gains		6.674	5.205458	8.10395	.002

*Pre-test score subtracted from Post-test score
**Level of significance on two-tailed test

Statistics on Metropolitan Reading Tests

Table XI, page 162, presents the mean pre-test, post-test and gains scores, the standard deviations of these scores and the "t" ratios of performance in word knowledge and reading as measured by the Metropolitan Reading Tests. Inspection of Table XI reveals that although there were positive changes from pre- to post-testing, the gains in word knowledge and reading were not significant at the .05 level. It should be noted, however, that the gain in reading approached this level of significance.

TABLE XI

Mean Pre-test, Post-test, and Gains Scores of the Experimental Group on the Metropolitan Reading Tests (1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Word Knowledge	Pre-	34	16.441176	7.5123		
	Post-	34	17.205882	7.8152		
	*Gains		0.764706	5.918935	0.73983	N.S.
Reading	Pre-	34	15.058823	5.7098		
	Post-	34	16.382352	7.5679		
	Gains		1.323529	5.929586	1.27881	N.S.

*Pre-test score subtracted from Post-test score
**Level of significance on two-tailed test

Statistics on Metropolitan Arithmetic Test

Table XII, page164, presents the pre-test, post-test, and gains scores, the standard deviations of these scores and the "t" ratios of performance in computation and problem solving and concepts as measured by the Metropolitan Arithmetic Test. Inspection of Table XII reveals a gain in computation significant at the high level of .002 and a gain in problem solving and concepts highly significant at the .01 level.

TABLE XII

Mean Pre-test, Post-test and Gains Scores of the Experimental Group on the Metropolitan Arithmetic Test
(1972)

Test	N	Mean	S.D.	"t"	**Level of Significance
Computation	Pre- 35	15.742857	11.9517		
	Post- 35	20.085714	10.9070		
	*Gains	4.342857	4.862478	5.28039	.002
Problem Solving and Concepts	Pre- 28	9.892857	8.2432		
	Post- 28	12.035714	8.0851		
	Gains	2.142857	4.079889	2.77552	.01

*Pre-test score subtracted from post-test score
**Level of significance on two-tailed test

Statistics on Gilmore Oral Reading Test

Table XIII, page166, presents the pre-test, post-test, and gains scores, the standard deviations of these scores and the "t" ratios on the Gilmore Oral Reading Test. Inspection of Table XIII reveals gains in accuracy significant at the .002 level and gains in comprehension also significant at the .002 level. There was a loss in rate: words per minute, but this loss was not significant at the .05 level.

TABLE XIII

Mean Pre-test, Post-test and Gains Scores of the Experimental Group on the Gilmore Oral Reading Test (1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Accuracy	Pre-	38	10.315789	8.2235		
	Post-	38	16.000000	12.7978		
	*Gains		5.684211	7.079110	4.94608	.002
Comprehension	Pre-	38	15.868421	6.5064		
	Post-	38	20.842105	7.3430		
	Gains		4.973684	4.162162	7.36086	.002
Rate: Words per minute	Pre-	37	59.891892	32.4523		
	Post-	37	57.000000	30.5777		
	Gains		-2.891892	17.4256	-1.00881	N.S.

*Pre-test score subtracted from Post-test score
**Level of significance on two-tailed test

Statistics on Motor Tasks Tests

Table XIV, page 168, presents the pre-test, post-test and gains scores, the standard deviations of these scores and the "t" ratios on the Motor Tasks Tests. Examination of Table XIV reveals gains at high levels of significance on all tasks: balance beam (forwards, backwards, and sideways), balance board, skipping, hopping, ocular pursuits (tracking and convergence).

TABLE XIV

Mean Pre-test, Post-test, and Gains Scores of the Experimental Group on Motor Tasks
(1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Balance Beam Forwards	Pre-	38	4.05263	1.1137		
	Post-	38	4.78947	0.4741		
	*Gains		0.73684	1.057355	4.31409	.002
Balance Beam Backwards	Pre-	38	2.42105	1.0035		
	Post-	38	3.86842	1.0697		
	Gains		1.44737	1.155422	7.73606	.002
Balance Beam Sideways	Pre-	38	2.71053	0.9838		
	Post-	38	3.92105	0.7491		
	Gains		1.21052	1.017595	7.32975	.002
Balance Board	Pre-	38	3.34211	1.2579		
	Post-	38	4.63158	0.8517		
	Gains		1.28947	1.333716	5.96235	.002
Skipping	Pre-	38	4.31579	1.0608		
	Post-	38	4.92105	0.2733		
	Gains		0.60526	1.103766	3.35083	.002
Hopping	Pre-	38	4.15789	0.9733		
	Post-	38	4.92105	0.2733		
	Gains		0.76316	0.970772	4.82600	.002
Ocular Pursuits Tracking	Pre-	38	2.05263	0.8988		
	Post-	38	2.94737	0.2262		
	Gains		0.89474	0.8633	6.35458	.002
Convergence	Pre-	38	2.57895	0.8583		
	Post-	38	2.92105	0.4866		
	Gains		0.34210	0.7453	2.81213	.01

*Pre-test score subtracted from Post-test score
**Level of significance on two-tailed test

Extent of Remediation in Control Group

The second problem was to determine the extent of remediation in a control group composed of learning disabled elementary school pupils, by evaluating the group prior to the training and after the training period for perceptual, motor, arithmetical, and reading skills.

Statistics on Slingerland Screening Tests

Table XV, page 170, presents the mean pre-test, post-test, and gains scores, the standard deviations of these scores, and the "t" ratios of the control group on the Slingerland Screening Tests. Examination of Table XV reveals that no significant gains were made except in the category of visual perception-memory-kinesthetic where the gain was significant at the .02 level. Nonsignificant negative gains (increase in errors) from pre- to post-testing occurred in the following categories:

Copying-Page
Auditory Recall
Auditory Sounds
Auditory Association and
Total Errors Plus Self-corrections and Poor Formations

TABLE XV

Mean Pre-test, Post-test, and Gains Scores of the Control Group on the Slingerland Screening Tests for Identifying Children with Specific Language Disability
(1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Copying-Chart	Pre-	16	4.3125	4.4379		
	Post-	16	4.1875	3.4874		
	*Gains		0.125	5.22653	0.99492	N.S.
Copying-Page	Pre-	16	1.3750	1.8211		
	Post-	16	1.8125	2.0402		
	Gains		-0.4375	1.63172	-1.07862	N.S.
Visual Perception-Memory	Pre-	16	4.0000	1.7888		
	Post-	16	3.375	2.1252		
	Gains		0.625	1.99577	1.26266	N.S.
Visual Discrimination	Pre-	16	3.0625	2.2647		
	Post-	16	2.3125	2.0238		
	Gains		0.7500	1.84391	1.62698	N.S.
Visual Perception-Memory-Kinesthetic	Pre-	16	9.125	3.7036		
	Post-	16	7.000	3.1622		
	Gains		2.125	3.13847	2.71469	.02
Auditory Recall	Pre-	16	13.1875	6.5647		
	Post-	16	13.2500	7.8612		
	Gains		-0.0625	3.53023	-0.16448	N.S.
Auditory Sounds	Pre-	16	6.6875	4.7289		
	Post-	16	7.1250	4.9648		
	Gains		-0.4375	1.45914	-1.20617	N.S.
Auditory Association	Pre-	16	5.1875	5.3576		
	Post-	16	5.2500	2.8166		
	Gains		-0.0625	1.94828	-0.12318	N.S.
Total Errors	Pre-	19	45.3684	16.3782		
	Post-	19	42.4210	20.7506		
	Gains		2.9474	12.1494	1.05838	N.S.
Total Errors Plus Self-Corrections and Poor Formations	Pre-	19	51.78947	20.7350		
	Post-	19	53.63158	27.1420		
	Gains		-1.68421	18.9269	-0.38691	N.S.

*Post-test error score subtracted from Pre-test error score
**Level of significance on two-tailed test

Statistics on Frostig Developmental Test of Visual Perception

Table XVI, page 172, presents the mean pre-test, post-test, and gains scores, the standard deviations of these scores, and the "t" ratios in 5 areas of visual perception measured by the Frostig Test. Examination of Table XVI reveals no significant gains in any of the 5 categories. In the areas of figure ground perception and perception of position in space the changes from pre- to post-testing were in a negative direction.

TABLE XVI

Mean Pre-test, Post-test, and Gains Scores of the Control Group of the Frostig Developmental Test of Visual Perception (1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Eye-Motor Coordination	Pre-	14	18.714285	3.9307		
	Post-	14	19.071428	2.6736		
	*Gains		0.3571428	3.38792	0.39761	N.S.
Figure Ground	Pre-	14	19.285714	1.1387		
	Post-	14	19.142857	1.4046		
	Gains		-0.142857	0.94926	-0.55183	N.S.
Form Constancy	Pre-	14	11.714285	2.9724		
	Post-	14	12.500000	3.0318		
	Gains		0.785714	1.92868	1.53260	N.S.
Position in Space	Pre-	14	7.4285714	0.8516		
	Post-	14	6.9285714	1.0623		
	Gains		-0.5000000	1.01902	-1.83586	N.S.
Spatial Relations	Pre-	14	6.7142857	1.1387		
	Post-	14	6.7142857	0.8254		
	Gains		0.0000000	0.87704	0.00000	N.S.
Total	Pre-	16	63.000	9.7228		
	Post-	16	62.750	8.4182		
	Gains		-0.250	7.02057	-0.43871	N.S.

*Pre-test score subtracted from Post-test score

**Level of significance on two-tailed test

Statistics on Metropolitan Reading Tests

Table XVII, page 174, presents the mean pre-test, post-test, and gains scores, the standard deviation of these scores, and the "t" ratios of performance in word knowledge and reading as measured by the Metropolitan Reading Tests. Inspection of Table XVII reveals that there were no significant gains in word knowledge or reading. In the area of word knowledge the change was in a negative direction.

TABLE XVII

Mean Pre-test, Post-test and Gains Scores of the Control Group on the Metropolitan Reading Tests (1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Word Knowledge	Pre-	13	21.307692	12.4992		
	Post-	13	20.538461	15.9249		
	*Gains		-0.769231	7.47079	-0.34962	N.S.
Reading	Pre-	13	17.923076	8.4504		
	Post-	13	18.076923	9.8273		
	Gains		0.1538461	3.86966	0.13976	N.S.

*Pre-test score subtracted from Post-test score
**Level of significance on two-tailed test

Statistics on Metropolitan Arithmentic Test

Table XVIII, page 176, presents the pre-test, post-test, and gains scores, the standard deviations of these scores and the "t" ratios of performances in computation and problem solving and concepts as measured by the Metropolitan Arithmetic Test. Inspection of Table XVIII reveals no significant changes from pre- to post-testing. In both the category of computation and the category of problem solving and concepts the changes were in a negative direction.

TABLE XVIII

Mean Pre-test, Post-test, and Gains Scores of the Control Group on the Metropolitan Arithmetic Test (1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Computation	Pre-	14	18.714285	12.9045		
	Post-	14	18.000000	13.7225		
	*Gains		-0.714285	3.70920	-0.71621	N.S.
Problem Solving and Concepts	Pre-	12	12.500000	10.9751		
	Post-	12	12.166666	11.2236		
	Gains		-0.333333	2.22913	-0.51279	N.S.

*Pre-test score subtracted from Post-test score
**Level of significance on two-tailed test

Statistics on Gilmore Oral Reading Test

Table XIX, page178, presents the pre-test, post-test, and gains scores, the standard deviations of these scores and the "t" ratios on the Gilmore Oral Reading Test. Inspection of Table XIX reveals no significant change in accuracy; however, the direction of change was negative. In comprehension there was a gain significant at the .02 level. Change in rate: words per minute was in a negative direction but not at a significant level.

TABLE XIX

Mean Pre-test, Post-test and Gains Scores of the Control Group on the Gilmore Oral Reading Test (1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Accuracy	Pre-	18	13.9444	14.4594		
	Post-	18	13.0555	16.6961		
	*Gains		-0.8888	5.67646	-0.66519	N.S.
Comprehension	Pre-	18	17.2777	11.2605		
	Post-	18	19.9444	11.6693		
	Gains		2.6666	4.32502	2.61914	.02
Rate: Words Per Minute	Pre-	14	59.5714	40.4526		
	Post-	14	58.9286	44.7083		
	Gains		-0.6426	14.1617	-0.16909	N.S.

*Pre-test score subtracted from Post-test score
**Level of significance on two-tailed test

Statistics on Motor Tasks Tests

Table XX, page 180, presents the pre-test, post-test, and gains scores, the standard deviations of these scores and the "t" ratios on the Motor Tasks Tests. Examination of Table XX reveals no significant gains on any tasks. Performance on the balance beam (forwards and backwards) as well as skipping and hopping indicated changes in a negative direction but not to a significant degree.

TABLE XX

Mean Pre-test, Post-test, and Gains Scores of the Control Group on Motor Tasks
(1972)

Test		N	Mean	S.D.	"t"	**Level of Significance
Balance Beam Forwards	Pre-	15	4.5333	0.7432		
	Post-	15	4.3333	1.1126		
	*Gains		-0.2000	0.87829	-0.88192	N.S.
Balance Beam Backwards	Pre-	15	2.9333	1.1126		
	Post-	15	2.8666	1.1406		
	Gains		-0.0666	0.70374	-0.38524	N.S.
Balance Beam Sideways	Pre-	15	3.2666	0.9611		
	Post-	15	3.3333	1.2344		
	Gains		0.0666	1.34198	0.20202	N.S.
Balance Board	Pre-	15	3.8000	1.3732		
	Post-	15	3.9333	1.0328		
	Gains		0.1333	1.59759	0.31515	N.S.
Skipping	Pre-	15	4.3333	0.9759		
	Post-	15	4.2000	0.7745		
	Gains		-0.1333	1.24591	-0.43089	N.S.
Hopping	Pre-	15	4.6000	0.5070		
	Post-	15	4.2000	0.7745		
	Gains		-0.4000	0.91026	-1.70193	N.S.
Ocular Pursuits Tracking	Pre-	14	2.4286	0.7559		
	Post-	14	2.6429	0.4972		
	Gains		0.2143	0.5789	1.35719	N.S.
Convergence	Pre-	14	2.7857	0.4257		
	Post-	14	2.9286	0.2672		
	Gains		0.1429	0.3631	1.44247	N.S.

*Pre-test score subtracted from Post-test score
**Level of significance on two-tailed test

Intergroup Comparison of Extent of Remediation

It was hypothesized that the experimental and control groups would be significantly differentiated at the close of the experiment in perceptual-motor ability, certain aspects of intellectual functioning and performance in specific areas of learning and that the experimental group would be significantly more affected in these areas than would be the control group.

Table XXI, page 183, presents the intergroup differences with respect to mean gains scores on the Slingerland Screening Tests for Identifying Children with Specific Language Disability. Examination of Table XXI reveals that the experimental group trained with special methods of remediation made a larger gain than the control group in terms of reduction of total errors plus self-corrections and poor formations on the Slingerland Screening Tests and that this difference is highly significant at the .01 level. On the copying-page subtest the experimental group made a greater gain than the control group and the difference between the groups was significant at the .05 level. On the remaining subtests, with the exceptions of visual perception-memory-kinesthetic and auditory recall, the experimental group made larger gains than the control group but the differences between the groups were not significant at the .05 level. In the aforementioned categories of visual perception-memory-kinesthetic and auditory recall the control group made larger gains than the experimental group but the differences between groups were not significant at the .05 level.

TABLE XXI

Intergroup Differences of Mean Gains Scores in the Slingerland Screening Tests for Identifying Children with Specific Language Disability (1972)

Test	Mean E-C*	F	Level of Significance**	"t"	Level of Significance**
Copying-Chart	2.34	1.5587	N.S.	1.24629	N.S.
Copying-Page	1.50	2.2519	N.S.	2.21111	.05
Visual Perception-Memory	0.40	1.2733	N.S.	0.70778	N.S.
Visual Discrimination	0.25	1.5500	N.S.	0.50764	N.S.
Visual Perception-Memory-Kinesthetic	-1.41	1.3180	N.S.	-1.33151	N.S.
Auditory Recall	-2.03	3.5170	.02	-1.14559	N.S.
Auditory Sounds	1.66	4.7571	.02	1.94500	.1
Auditory Association	0.90	1.0944	N.S.	1.52940	N.S.
Total Errors	4.02	1.6218	N.S.	0.99179	N.S.
Total Errors Plus Self-Corrections and Poor Formations	13.96	1.1812	N.S.	2.78533	.01

*Mean gains scores of Control Group subtracted from same scores of the Experimental Group

**Level of significance on two-tailed test

Table XXII, page 185, presents the intergroup differences with respect to mean gains scores on the Frostig Developmental Test of Visual Perception, the F ratios and the "t" ratios. Examination of Table XXII reveals the experimental group made a larger gain than the control group on the total score and that this gain is highly significant at the .002 level. On the 5 subtests the experimental group made greater gains than the control group and the differences between groups were significant at the .05 level for figure ground perception and at the .01 level for form constancy. The differences between groups were not significant at the .05 level for eye-motor coordination, position in space and spatial relations although the difference closely approached significance for position in space.

TABLE XXII

Intergroup Differences of Mean Gains Scores on the Frostig Developmental Test of Visual Perception (1972)

Test	Mean E-C*	F	Level of Significance**	"t"	Level of Significance**
Eye-Motor Coordination	1.12	5.7182	.02	1.29207	N.S.
Figure Ground	1.17	3.8407	.02	2.24328	.05
Form Constancy	2.49	2.605	N.S.	2.77451	.01
Position in Space	0.68	1.1954	N.S.	2.00681	.10
Spatial Relations	0.43	1.2592	N.S.	1.44465	N.S.
Total	7.44	1.8189	N.S.	4.01719	.002

*Mean gains scores of Control Group subtracted from same scores of the Experimental Group

**Level of significance on two-tailed test

Table XXIII, page 187, presents the intergroup differences of mean gains scores on the Metropolitan Reading Tests, the F ratios and the "t" ratio. Inspection of Table XXIII reveals that greater gains in word knowledge and reading were made by the experimental group but not at the level of significance.

In the opinion of the testers, the pupils characteristically reacted to multiple-choice questions with guessing. They seemed unable to resist the temptation to follow their prior mode of response of putting check marks in little squares without reading the alternatives.

TABLE XXIII

Intergroup Differences of Mean Gains Scores on the Metropolitan Reading Tests (1972)

Test	Mean E-C*	F	Level of Significance**	"t"	Level of Significance**
Word Knowledge	1.53	1.7998	N.S.	0.70319	N.S.
Reading	1.17	2.4191	N.S.	0.63421	N.S.

*Mean gains scores of Control Group subtracted from same scores of the Experimental Group

**Level of significance on two-tailed test

Table XXIV, page 189, presents the intergroup differences with respect to mean gains scores on the Metropolitan Arithmetic Test, the F ratios and the "t" ratios. Inspection of Table XXIV reveals the experimental group achieved greater gains than the control group in arithmetical computation and the difference between groups is highly significant at the .002 level. Greater gains were attained by the experimental group in problem solving and concepts but the difference between groups although approaching significance at the .05 level was significant only at the .10 level.

TABLE XXIV

Intergroup Differences of Mean Gains Scores on the Metropolitan Arithmetic Test (1972)

Test	Mean E-C*	F	Level of Significance**	"t"	Level of Significance**
Computation	5.05	1.7185	N.S.	3.49237	.002
Problem Solving and Concepts	2.47	3.3493	N.S.	1.96549	.10

*Mean gains scores of Control Group subtracted from same scores of the Experimental Group

**Level of significance on two-tailed test

Table XXV, page 191, presents the intergroup differences with respect to mean gains scores on the Gilmore Oral Reading Test, the F ratios and the "t" ratios. Inspection of Table XXV reveals that a greater gain was made by the experimental group in accuracy and that the difference between groups is highly significant at the .002 level. The experimental group made a greater gain than the control group in comprehension by the difference between groups is not significant at the .05 level although approaching it with significance at the .10 level. The experimental group lost more than the control group in rate: words per minute but the difference between groups was not significant at the .05 level. It seems likely that as pupils increased in accuracy they read more carefully and thus more slowly.

TABLE XXV

Intergroup Differences of Mean Gains Scores on the Gilmore Oral Reading Test (1972)

Test	Mean E-C*	F	Level of Significance**	"t"	Level of Significance**
Accuracy	6.57	1.5552	N.S.	3.44279	.002
Comprehension	2.30	1.0797	N.S.	1.90746	.10
Rate: Words per minute	-2.25	1.5141	N.S.	-0.43139	N.S.

*Mean gains scores of Control Group subtracted from same scores of the Experimental Group

**Level of significance on two-tailed test

Table XXVI, page 193, presents the intergroup differences of mean gains scores on the Test of Motor Tasks, the F ratios and the "t" ratios. Examination of Table XXVI reveals that the experimental group made greater gains than the control group on all tasks and the differences between groups achieved high levels of significance in all tasks except ocular convergence which was not significant at the .05 level.

TABLE XXVI

Intergroup Differences of Mean Gains Scores on Motor Tasks (1972)

Test	Mean E-C*	F	Level of Significance**	"t"	Level of Significance**
Balance Beam Forwards	0.94	1.4493	N.S.	3.04796	.01
Balance Beam Backwards	1.52	2.6958	N.S.	4.74312	.002
Balance Beam Sideways	1.14	1.7391	N.S.	3.34967	.002
Balance Board	1.16	1.4348	N.S.	2.69590	.01
Skipping	0.73	1.2741	N.S.	2.09158	.05
Hopping	1.16	1.1374	N.S.	3.98531	.002
Ocular Pursuits Tracking	0.68	2.2237	N.S.	2.72145	.01
Convergence	0.20	4.2115	.02	0.95859	N.S.

*Mean gains scores of Control Group subtracted from same scores of the Experimental Group

**Level of significance on two-tailed test

Summary

The intergroup differences are conveniently summarized in Table XXVII, page 195, Table XXVIII, page 196, and Table XXIX, page 197. On the basis of the total data concerning the experimental group and the control group as well as the intergroup comparisons the following observations may be made:

1. Out of 31 possible test scores the experimental group made 29 positive gains, 25 of which were significant. Two scores were nonsignificant negative gains.
2. Out of 31 possible test scores the control group made 13 positive gains, 2 of which were significant. Seventeen were nonsignificant negative gains. One gains score was zero.
3. An intergroup comparison showed the experimental group with 28 positive gains over the control group, 14 of which were significant. Three scores were nonsignificant negative gains.

TABLE XXVII

Summary of Test Gains Favoring the Experimental Group with Significant Intergroup Differences

(1972)

Test	Level of Significance
Slingerland Screening Tests	
Copying-Page	.05
Auditory Sounds	.10*
Total Errors Plus Self-Corrections and Poor Formations	.01
Frostig Developmental Test	
Figure-Ground	.05
Form Constancy	.01
Position in Space	.10*
Total	.002
Metropolitan Arithmetic Test	
Computation	.002
Problem Solving and Concepts	.10*
Gilmore Oral Reading Test	
Accuracy	.002
Comprehension	.10*
Motor Tasks Test	
Balance Beam	
Forwards	.01
Backwards	.002
Sideways	.01
Balance Board	.01
Skipping	.05
Hopping	.002
Tracking	.01

* Approaching but less than significance

TABLE XXVIII

Summary of Gains Favoring the Experimental Group with Nonsignificant Intergroup Differences (1972)

Test	Level of Significance
Slingerland Test	
Copying-Chart	N.S.
Visual Perception-Memory	N.S.
Visual Discrimination	N.S.
Auditory Sounds	.10*
Auditory Association	N.S.
Total Errors	N.S.
Frostig Developmental Test	
Eye-Motor Coordination	N.S.
Position in Space	.10*
Spatial Relations	N.S.
Metropolitan Reading Test	
Word Knowledge	N.S.
Reading	N.S.
Metropolitan Arithmetic Test	
Problem Solving and Concepts	.10*
Gilmore Oral Reading Test	
Comprehension	.10
Motor Task Test	
Convergence	N.S.

* Approaching but less than significance

TABLE XXIX

Summary of Gains Favoring the Control Group with Nonsignificant Intergroup Differences

(1972)

Test	Level of Significance
Slingerland Screening Tests	
Visual Perception-Memory -Kinesthetic	N.S.
Auditory Recall	N.S.
Gilmore Oral Reading Test	
Rate: Words per Minute	N.S.

Conclusions

The following conclusions are drawn from the statistical analysis of the data:

1. The methods of remediation employed in this research enabled the pupils exposed to this training to gain significantly over pupils in a control group in Copying-page and Reduction of Total Errors Plus Self-Corrections and Poor Formations as measured by the Slingerland Screening Tests for Identifying Children with Specific Language Disability.
2. Pupils exposed to remediation training gained significantly over pupils in a control group in Figure-ground Perception, Perception of Form Constancy and Total Score as measured by the Frostig Developmental Test of Visual Perception.
3. The remediation methods, as outlined, enabled pupils in an experimental group to gain significantly over pupils in a control group in Arithmetic Computation as measured by the Metropolitan Arithmetic Test.
4. Pupils exposed to methods of remediation gained significantly over control pupils on Reading Accuracy as measured by the Gilmore Oral Reading Test.
5. Pupils trained with methods of remediation gained significantly over control pupils on the motor tasks

of balancing, skipping, hopping and visual tracking as measured by a motor task test.

6. Pupils exposed to the specified remediation methods gained, but not significantly, over pupils in a control group in Copying-chart, Visual Perception-memory, Visual Discrimination, Auditory Sounds, Auditory Association, and Reduction of Total Errors as measured by the Slingerland Screening Tests for Identifying Children with Specific Language Disability.
7. Remediation methods enabled pupils in an experimental group to gain, but not significantly, over pupils in a control group on Eye-motor Coordination, Position in Space and Spatial Relations as measured by the Frostig Developmental Test of Visual Perception.
8. Pupils exposed to remediation training gained, but not significantly, over pupils in a control group in Word Knowledge and Reading as measured by the Metropolitan Reading Test.
9. Remediation methods enabled pupils in an experimental group to gain, but not significantly, over pupils in a control group in Problem Solving and Concepts as measured in the Metropolitan Arithmetic Test.
10. Pupils exposed to remediation training gained, but not significantly, over pupils in a control group in Comprehension as measured by the Gilmore Oral Reading Test.

11. Remediation methods enabled pupils in an experimental group to gain, but not significantly, over pupils in a control group in Ocular Convergence as measured by the Motor Task Test.

CHAPTER IV

RESULTS: TREATMENT AND INTERPRETATION OF DATA (1973)

Statistics Indicating the Comparability of Groups

The assumption that experimental and control groups were comparable with regard to sex and age is supported by the data indicated in Table I, page 202. The difference in the composition of the groups in regard to sex is only 2 per cent. The ranges, means, and standard deviations of age are closely comparable. The F and "t" ratios indicate no significant difference between the groups in age.

TABLE I

Description and Comparison of Elementary School Experimental and Control Groups with Regard to Sex and Age (1973)

	Experimental			Control	
	Male	Female		Male	Female
N	27	8		15	5
Percentage	77	23		75	25
Age: Mean	10.01	10.21		9.92	9.55
Range	6.75-13.75	6.92-13.08		6.75-12.92	7.67-15.83
Mean	10.06			9.8291	
S.D.	2.1925			2.3020	
F			1.10238		
"t"			.3643*		

* Not significant at .05 level of significance

The similarity of the two groups in terms of sex and intelligence is indicated by Table II, page 204, showing Verbal I.Q., Performance I.Q., and Full Scale I.Q. measured on the Wechsler Preschool and Primary Scale of Intelligence. The F and "t" ratios indicate no significant differences between groups in intelligence.

TABLE II

Description and Comparison of Elementary School Experimental and Control Groups with Regard to Sex and Intelligence (1973)

	Experimental		Control	
	Male	Female	Male	Female
N	27	8	15	5
Verbal I.Q.				
Mean	95.89	94.46	91.67	93.50
Range	72-124	80-110	72-100	70.123
Mean	94.46		93.60	
S.D.	11.094		12.8857	
F		1.34908		
"t"		.2598*		
Performance I.Q.				
Mean	103.70	98.00	95.20	90.00
Range	58-150	82-118	76-118	69-114
Mean	102.40		95.100	
S.D.	16.5497		14.4145	
F		1.31819		
"t"		1.6464*		
Full Scale I.Q.				
Mean	99.37	97.91	92.60	91.25
Range	77-133	84-104	76-107	67-120
Mean	97.91		93.700	
S.D.	11.7332		13.8073	
F		1.38479		
"t"		1.2011*		

*Not significant at .05 level of significance

The similarity of the two groups is further shown by comparisons of pre-test scores on the following tests indicated by the respective tables:

Slingerland Screening Tests for Identifying Children with Specific Language Disability, Table III, page 206

Frostig Developmental Test of Visual Perception, Table IV, page 207

Metropolitan Reading Tests, Table V, page 208

Metropolitan Arithmetic Tests, Table VI, page 209

Gilmore Oral Reading Test, Table VII, page 210

Test of Motor Tasks, Table VIII, page 211

However, since this research is concerned with gains scores, differences between groups in initial ability would not invalidate a comparison of the groups.

TABLE III

Comparison of Pre-test Scores of Elementary School Experimental and Control Groups on the Slingerland Screening Tests for Identifying Children with Specific Language Disability

(1973)

			(Errors)			
Test		N	Mean	Range	S.D.	F
Copying-Chart	*E	23	5.5217	1-13	3.5402	4.1067
	**C	17	5.7059	0-28	7.1743	
Copying-Page	E	23	1.6957	1-9	2.2245	5.1843
	C	17	2.8235	0-21	5.0650	
Visual Perception -Memory	E	23	3.7391	1-10	2.1787	1.4673
	C	17	3.8823	1-8	1.7986	
Visual Discrimination	E	23	2.5217	1-7	1.2745	3.0010
	C	17	3.0000	0-7	2.2079	
Visual Perception -Memory-Kinesthetic	E	23	6.4348	2-14	3.2168	1.2470
	C	17	9.1764	3-15	3.5922	
Auditory Recall Letters	E	23	1.6521	1-4	1.1912	1.1503
	C	17	1.5882	0-4	1.2776	
Auditory Recall Numbers	E	23	1.2174	1-4	1.0852	1.1606
	C	17	1.5294	0-3	1.0073	
Auditory Recall Spelling	E	23	8.2609	1-19	4.7789	1.5737
	C	17	9.7647	2-20	5.9950	
Auditory Sounds	E	23	5.1739	1-12	3.7495	1.5030
	C	17	6.5982	1-17	4.5969	
Auditory Association	E	23	3.3043	1-10	2.2891	1.4448
	C	17	5.1176	1-12	3.3889	
Total Errors	E	23	31.1739	8-55	11.9683	1.8096
	C	19	39.5000	22-79	16.1000	
Total Errors Plus Self-Corrections and Poor Formations	E	23	47.1739	25-95	18.9632	1.0850
	C	18	53.9444	34-107	19.7528	

* Experimental Group

** Control Group

TABLE IV

Comparison of Pre-test Scores of Elementary School Experimental and Control Groups on the Frostig Developmental Test of Visual Perception

(1973)

			(Scale Score)			
Test		N	Mean	Range	S.D.	F
Eye-Motor Coordination	*E	30	9.7926	6-15	1.6600	1.1996
	**C	17	9.1029	6-13	1.5156	
Figure-Ground	E	30	9.1370	5.5-11	1.2525	1.3467
	C	17	9.6176	7-11	1.0793	
Form Constancy	E	30	9.2736	6.6-13	1.5998	1.2721
	C	17	8.6912	6-11	1.4184	
Position in Space	E	30	8.5997	6-12	1.6725	1.1810
	C	17	9.1000	6-11	1.5394	
Spatial Relations	E	30	9.0460	7.5-12	1.1483	1.0568
	C	17	9.1912	5-11	1.4830	
Total Scaled Score	E	30	45.8203	36.25-60	4.9473	1.1854
	C	17	45.7618	35-57	5.3866	
Perceptual Quotient	E	30	91.8406	76-125	10.6411	1.6904
	C	17	91.9647	73-114	13.8352	

* Experimental Group
** Control Group

TABLE V

Comparison of Pre-test Scores of Elementary School Experimental and Control Groups on the Metropolitan Reading Tests

(1973)

Test		N	Mean	Range	S.D.	F
Word Knowledge	*E	28	15.8571	6-39	7.9195	2.5128
	**C	14	22.2857	8-43	12.5540	
Reading	E	28	13.8214	3-29	6.4351	1.5518
	C	12	20.0833	12-35	8.0165	

* Experimental Group
** Control Group

TABLE VI

Comparison of Pre-test Scores of Elementary School Experimental and Control Groups on the Metropolitan Arithmetic Tests (1973)

Test		N	Mean	Range	S.D.	F
Computation	*E	25	16.4400	1-28	7.6326	2.8584
	**C	14	18.7142	3-44	12.9045	
Problem Solving and Concepts	E	25	15.4800	3-28	7.9010	1.7917
	C	11	13.3636	2-32	10.5761	

* Experimental Group

** Control Group

TABLE VII

Comparison of Pre-test Scores of Elementary School Experimental and Control Groups on the Gilmore Oral Reading Test

(1973)

Test		N	Mean	Range	S.D.	F
Accuracy	*E	27	12.8148	1-37	11.4859	1.6202
	**C	17	15.0000	0-47	14.6201	
Comprehension	E	27	18.6296	1-35	9.0219	1.2228
	C	16	19.2500	3-40	9.9766	
Rate: Words per Minute	E	27	57.3222	9-135.6	37.5055	1.3474
	C	16	63.7500	18-144	43.5361	

* Experimental Group
**Control Group

TABLE VIII

Comparison of Pre-test Scores of Elementary School Experimental and Control Groups on Motor Tasks

(1973)

Task		N	Mean	Range	S.D.	F
Balance Beam Forwards	*E	27	4.5677	2-5	.9735	1.0741
	**C	17	4.4117	3-5	.9393	
Balance Beam Backwards	E	27	3.1174	1-5	.9844	1.6767
	C	15	3.0000	1-5	1.2747	
Balance Beam Sideways	E	27	3.4625	2-5	.7944	1.9689
	C	14	3.3529	2-5	1.1147	
Balance Board	E	27	4.2844	1-5	1.0115	2.0839
	C	15	3.5882	1-5	1.4602	
Skipping	E	27	4.2962	1-5	1.2554	.7572
	C	15	4.1176	2-5	.8702	
Hopping	E	27	4.6051	3-5	.6669	1.1633
	C	15	4.5882	3-5	.6183	
Ocular Pursuits						
Tracking	E	27	2.6237	1-3	.5263	2.7527
	C	14	2.3125	1-3	.8732	
Convergence	E	27	2.8396	2-3	.3381	6.8516
	C	14	2.6250	1-3	.8850	
Mirror Movement						
Hand Tapping	E	17	1.2592	1-3	.4922	3.4899
	C	17	1.7058	1-4	.9195	
Finger Touching (Right Hand)	E	17	1.8025	1-3	.6744	1.8914
	C	17	2.1176	1-4	.9275	
Finger Touching (Left Hand)	E	17	2.1414	1-4	.8452	2.3133
	C	17	1.9411	1-3	.5557	

* Experimental Group
** Control Group

Statistical Procedure

In order to determine the extent of remediation of learning disability in an experimental group and a control group by evaluating each group prior to the training and after the training for certain aspects of intellectual functioning, perceptual ability, and motor skills the t-statistic for dependent paired data was used. The following steps were taken:

1. The scores for each measure, pre- and post-, were obtained for each subject in the group.
2. The difference between each pre- and post-score for each measure was obtained for each subject in the group.
3. This data was entered into a Monroe Model 1930 electronic display calculator for statistics programmed to calculate the t-statistic for dependent paired data according to the following formula:

$$t_d = \frac{\bar{X} - \bar{Y}}{\sqrt{\dfrac{\sigma_x^2 + \sigma_y^2 - 2r\sigma_x\sigma_y}{n}}} \quad ^1$$

where: $\bar{X} = \frac{\Sigma x}{n}$; $\bar{Y} = \frac{\Sigma y}{n}$; σ_x = standard deviation of X; y = standard deviation of Y; r = correlation coefficient.

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[1] *Operating Instructions: Model 1930 Electronic Display Calculator for Statistics*. Orange, New Jersey: Monroe, The Calculator Company, 1974, p. 22.

Going into the "t" tables with n-1 degrees of freedom, it was possible to determine whether these differences were significant at the five per cent level of confidence. The means and standard deviations of the differences of each measure indicated the extent to which the training objectives were attained and the measure obtained with the "t" formula indicated whether or not these differences were significant at the five per cent level of confidence.

In order to make an intergroup comparison the pre- to post-test differences of the experimental and control groups were entered into the Monroe Model 1930 Calculator set to analyze the data with the t-statistic for independent X and Y data according to the following formula:[1]

$$t_i = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{(n_x - 1)\,\sigma_x^2 + (n_y - 1)\,\sigma_y^2}{n_x + n_y - 2}\left(\frac{1}{n_x} + \frac{1}{n_y}\right)}}$$

where: $X = \frac{\sum x}{n_x}$; $Y = \frac{\sum y}{n_y}$; σ_x = standard deviation of X sample; σ_y = standard deviation of Y sample.

Going into the "t" tables with n + n - 2 degrees of freedom, it was possible to determine whether these differences were significant at the five per cent level.

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[1] Loc. cit.

The initial comparability of groups was determined by assessing means, ranges, standard deviations and F ratics. The F ratio indicated degree of homogeneity according to the following formula:

$$F = \frac{\text{larger variance}}{\text{smaller variance}}^{1}$$

$$F = \frac{\dfrac{\sum d_1^2}{N_1 - 1}}{\dfrac{\sum d_2^2}{N_2 - 1}}$$

where: d^2 = sum of squares of the sample.

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[1] Guilford, J. P., Fundamental Statistics in Psychology and Education. New York: McGraw-Hill, 1950, p.232.

Extent of Remediation in Experimental Group

The first problem was to determine the extent of remediation in an experimental group composed of learning disabled elementary school children by evaluating the group prior to the training and after the training period for perceptual, motor, reading, and arithmetical skills.

Statistics on the Slingerland Screening Test for Identifying Children with Specific Language Disability

Table IX, page 216, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Slingerland Screening Test for Identifying Children with Specific Language Disability. Significant gains were indicated in the category of Visual-Perception-Memory. Gains closely approaching significance were made in the categories of Visual Discrimination and Auditory Recall (Numbers). Of the remaining 9 categories gains in a positive direction (decrease in errors) were made in 2 categories only--Auditory Recall (Spelling) and Total Errors Plus Self-Corrections and Poor Formations.

TABLE IX

Mean Pre-test, Post-test, and Gains Scores of Elementary School Experimental Group on the Slingerland Screening Tests for Identifying Children with Specific Language Disability (1973)

Test		N	(Errors) Mean	S.D.	"t"	Level of Sig.**
Copying-Chart	Pre-	23	5.5217	3.5402		
	Post-	23	6.3913	5.4916		
	*Gains		- .8696	5.1812	.8048	N.S.
Copying-Page	Pre-	23	1.6957	2.2245		
	Post-	23	1.7391	2.0936		
	Gains		- .0434	2.4950	.0835	N.S.
Visual Perception-Memory	Pre-	23	3.7391	2.1787		
	Post-	23	2.2174	1.8575		
	Gains		1.5217	2.7776	2.6273	.05
Visual Discrimination	Pre-	23	2.5217	1.2745		
	Post-	23	1.9565	1.4917		
	Gains		.5652	1.4405	1.8817	.10
Visual Perception-Memory-Kinesthetic	Pre-	23	6.4348	3.2168		
	Post-	23	6.5652	3.5268		
	Gains		- .1304	3.1809	.1966	N.S.
Auditory Recall Letters	Pre-	23	1.6521	1.1912		
	Post-	23	1.7826	1.2776		
	Gains		- .1305	1.7136	.3650	N.S.
Auditory Recall Numbers	Pre-	23	1.2174	1.0852		
	Post-	23	.8696	.8148		
	Gains		.3478	.9346	1.7848	.10
Auditory Recall Spelling	Pre-	23	8.2609	4.7789		
	Post-	23	7.9120	4.8139		
	Gains		.3489	.9346	.3935	N.S.
Auditory Sounds	Pre-	23	5.1739	3.7495		
	Post-	23	5.6522	3.5369		
	Gains		- .4783	3.5785	.6409	N.S.
Auditory Association	Pre-	23	3.3043	2.8193		
	Post-	23	3.6522	2.4607		
	Gains		- .3478	2.0362	.8192	N.S.
Total Errors	Pre-	23	31.1739	11.9683		
	Post-	23	31.2609	13.4273		
	Gains		- .0870	10.8916	.0382	N.S.
Total Errors Plus Self-Corrections and Poor Formations	Pre-	23	47.1739	18.9632		
	Post-	23	42.0870	15.1624		
	Gains		5.0869	16.4737	1.4483	N.S.

* Post-test error score subtracted from Pre-test error score

** Level of significance on two-tailed test

Statistics on the Frostig Developmental Test of Visual Perception

Table X, page 218, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Frostig Developmental Test of Visual Perception. Examination of Table X reveals that highly significant gains were made in eye-motor coordination and that gains closely approaching significance were made in perception of form constancy and in the perceptual quotient.

TABLE X

Mean Pre-test, Post-test, and Gains Scores of Elementary School Experimental Group on the Frostig Developmental Test of Visual Perception

(1973)

Test		N	(Scale Score) Mean	S.D.	"t"	Level of Sig.**
Eye-Motor Coordination	Pre-	30	9.7926	1.6600		
	Post-	30	8.6886	1.7575		
	*Gains		-1.1040	2.0781	2.9097	.01
Figure-Ground	Pre-	30	9.1370	1.2525		
	Post-	30	9.0593	1.5303		
	Gains		- .0777	1.8834	.2258	N.S.
Form Constancy	Pre-	30	9.2736	1.5998		
	Post-	30	8.7143	1.4632		
	Gains		- .5593	1.6358	1.8428	.10
Position in Space	Pre-	30	8.5997	1.6725		
	Post-	30	8.8703	2.0309		
	Gains		.2706	2.1133	.7014	N.S.
Spatial Relations	Pre-	30	9.0460	1.1483		
	Post-	30	8.9107	1.1805		
	Gains		- .1353	.8769	.8452	N.S.
Total	Pre-	30	45.8203	4.9473		
	Post-	30	44.3260	5.1586		
	Gains		-1.4943	4.1783	1.9588	N.S.
Perceptual Quotient	Pre-	30	91.8406	10.6411		
	Post-	30	88.7186	11.1668		
	Gains		-3.1220	8.3901	2.0380	.10

* Pre-test score subtracted from Post-test score
** Level of significance on two-tailed test

Statistics on the Metropolitan Reading Tests

Table XI, page 220, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Metropolitan Reading Tests. Examination of this table reveals nonsignificant negative gains in both word knowledge and reading.

TABLE XI

Mean Pre-test, Post-test, and Gains Scores
of Elementary School Experimental Group
on the Metropolitan Reading Tests

(1973)

			(Raw Scores)			Level
Test		N	Mean	S.D.	"t"	of Sig.**
Word Knowledge	Pre-	28	15.8571	7.9195		
	Post-	28	14.2500	9.1068		
	*Gains		-1.6071	5.5733	1.5258	N.S.
Reading	Pre-	28	13.8214	6.4351		
	Post-	28	12.2142	5.4321		
	Gains		-1.6072	4.6135	1.8433	.10

* Pre-test score subtracted from Post-test score
** Level of significance on two-tailed test

Statistics on the Metropolitan Arithmetic Tests

Table XII, page 222, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Metropolitan Arithmetic Tests. Examination of this table reveals a significant gain in computation and a positive, but nonsignificant, gain in problem solving and concepts.

TABLE XII

Mean Pre-test, Post-test, and Gains Scores
of Elementary School Experimental Group
on the Metropolitan Arithmetic Tests
(1973)

Test		N	Mean	S.D.	"t"	Level of Sig.**
Computation	Pre-	25	16.4400	7.6326		
	Post-	25	18.4000	8.0311		
	*Gains		1.9600	4.1880	2.3399	.05
Problem Solving & Concepts	Pre-	25	15.4800	7.9010		
	Post-	25	18.2800	9.5066		
	Gains		2.8000	8.2259	1.7019	N.S.

* Pre-test scores subtracted from Post-test scores
** Level of significance on two-tailed test

Statistics on the Gilmore Oral Reading Test

Table XIII, page 224, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Gilmore Oral Reading Test. Examination of this table reveals a significant gain in the accuracy score, a nonsignificant positive gain in the comprehension score, and a nonsignificant negative score in rate of reading.

TABLE XIII

Mean Pre-test, Post-test, and Gains Scores
of Elementary School Experimental Group
on the Gilmore Oral Reading Test
(1973)

Test		N	Mean	S.D.	"t"	Level of Sig.**
Accuracy Score	Pre-	27	12.8148	11.4859		
	Post-	27	15.8518	13.1374		
	*Gains		3.0370	5.7343	2.7519	.05
Comprehension Score	Pre-	27	18.6296	9.0219		
	Post-	27	21.0000	9.3315		
	Gains		2.3704	8.8411	1.3931	N.S.
Rate: Words per Minute	Pre-	27	57.3222	37.5055		
	Post-	27	52.1148	30.4473		
	Gains		-5.2074	19.7779	1.3681	N.S.

* Pre-test score subtracted from Post-test score
** Level of significance on two-tailed test

Statistics on Test of Motor Tasks

Table XIV, page 226, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the experimental group on the Test of Motor Tasks. Examination of this table reveals significant gains in walking the balance beam backwards and walking the balance beam sideways. A significant increase occurred in mirror movement as indicated by finger touching with the right hand. Of the remaining 8 tasks, 4 indicated nonsignificant negative gains and 4 indicated nonsignificant positive gains.

TABLE XIV

Mean Pre-test, Post-test, and Gains Scores
of Elementary School Experimental Group
on Motor Tasks
(1973)

Task		N	Mean	S.D.	"t"	Level of Sig.**
Balance Beam Forwards	Pre-	27	4.5677	.9735		
	Post-	27	4.6788	.5434		
	*Gains		.1111	.8268	.6512	N.S.
Balance Beam Backwards	Pre-	27	3.1174	.9844		
	Post-	27	3.9262	.9263		
	Gains		.8088	.9273	4.5323	.001
Balance Beam Sideways	Pre-	27	3.4625	.7944		
	Post-	27	4.0496	.6899		
	Gains		.5870	.8039	3.7940	.001
Balance Board	Pre-	27	4.2844	1.0115		
	Post-	27	4.0992	.9988		
	Gains		- .1851	.9349	1.0291	N.S.
Skipping	Pre-	27	4.2962	1.2554		
	Post-	27	4.4200	.9810		
	Gains		.1237	1.0135	.6341	N.S.
Hopping	Pre-	27	4.6051	.6669		
	Post-	27	4.3085	.8326		
	Gains		- .2966	.8393	1.8365	.10
Ocular Pursuits Tracking	Pre-	27	2.6237	.5263		
	Post-	27	2.7533	.3534		
	Gains		.1296	.5524	1.2192	N.S.
Convergence	Pre-	27	2.8396	.3381		
	Post-	27	2.7900	.6004		
	Gains		- .0496	.7148	.3607	N.S.
Mirror Movement Hand Tapping	Pre-	27	1.2592	.4922		
	Post-	27	1.3581	.7280		
	***Gains		- .0988	.7161	.7175	N.S.
Finger Touching (Right Hand)	Pre-	27	1.8025	.6744		
	Post-	27	2.2470	.5436		
	***Gains		- .4444	.6904	3.3446	.01

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* Pre-test score subtracted from Post-test score

** Level of significance on two-tailed test

*** Post-test score subtracted from Pre-test score because lower score is more desirable

TABLE XIV (Continued)

Mean Pre-test, Post-test, and Gains Scores
of Elementary School Experimental Group
on Motor Tasks
(1973)

Task		N	Mean	S.D.	"t"	of Sig.**
Finger	Pre-	27	2.1414	.8452		
Touching	Post-	27	2.1237	.6612		
(Left Hand)	***Gains		.0177	.8349	.1106	N.S.

* Post-test score subtracted from Pre-test score because lower score is more desirable

***Level of significance on two-tailed test

Extent of Remediation in Control Group

The second problem was to determine the extent of remediation in a control group composed of learning disabled elementary school children by evaluating the group prior to the training and after the training period for perceptual, motor, reading, and arithmetical skills.

Statistics on the Slingerland Screening Test for Identifying Children with Specific Language Disability

Table XV, page 229, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Slingerland Screening Test for Identifying Children with Specific Language Disability. Significant gains were indicated in the category of Visual-Perception-Memory-Kinesthetic Gains in the category of Auditory Recall (Numbers) approached significance but gains in all other categories were nonsignificant. The categories of Auditory Recall (Spelling) and Auditory Sound indicated nonsignificant negative gains.

TABLE XV

Mean Pre-test, Post-test, and Gains Scores of Elementary School Control Group on the Slingerland Screening Tests for Identifying Children with Specific Language Disability (1973)

Test		N	(Errors) Mean	S.D.	"t"	Level of Sig.**
Copying-Chart	Pre-	17	5.7059	7.1473		
	Post-	17	4.5294	3.6591		
	*Gains		1.1765	6.6636	.7279	N.S.
Copying-Page	Pre-	17	2.8235	5.0650		
	Post-	17	1.8235	1.9759		
	Gains		1.0000	5.0744	.8125	N.S.
Visual Perception-Memory	Pre-	17	3.8823	1.7986		
	Post-	17	3.2352	2.2136		
	Gains		.6471	1.9345	1.2790	N.S.
Visual Discrimination	Pre-	17	3.0000	2.2079		
	Post-	17	2.3529	1.9666		
	Gains		.6471	1.8351	1.4538	N.S.
Visual Perception-Memory-Kinesthetic	Pre-	17	9.1764	3.5922		
	Post-	17	6.9411	3.0714		
	Gains		2.2353	3.0726	2.9994	.01
Auditory Recall Letters	Pre-	17	1.5882	1.2776		
	Post-	17	1.5882	1.3719		
	Gains		.0000	.0000	0.0000	N.S.
Auditory Recall Numbers	Pre-	17	1.5294	1.0073		
	Post-	17	1.0000	1.1726		
	Gains		.5294	1.1245	1.9409	.10
Auditory Recall Spelling	Pre-	17	9.7647	5.9950		
	Post-	17	10.4117	7.0094		
	Gains		- .6470	3.2966	.8092	N.S.
Auditory Sound	Pre-	17	6.5882	4.5969		
	Post-	17	6.8823	4.9102		
	Gains		- .2941	1.5315	.7918	N.S.
Auditory Association	Pre-	17	5.1176	3.3889		
	Post-	17	5.1176	2.7812		
	Gains		.0000	.0000	.0000	N.S.
Total Errors	Pre-	19	39.5000	16.1000		
	Post-	19	38.6500	20.8712		
	Gains		.8500	12.0187	.3162	N.S.
Total Errors Plus Self-Corrections and Poor Formations	Pre-	18	53.9444	19.7528		
	Post-	18	50.3330	19.7633		
	Gains		3.6114	15.8230	.9682	N.S.

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* Post-test error score subtracted from Pre-test error score

** Level of significance on two-tailed test

Statistics on the Frostig Developmental Test of Visual Perception

Table XVI, page 231, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Frostig Developmental Test of Visual Perception. Examination of Table XVI reveals that no significant gains were made in any of the 5 categories of visual perception nor in the total score on the perceptual quotient.

TABLE XVI

Mean Pre-test, Post-test, and Gains Scores of Elementary School Control Group on the Frostig Developmental Test of Visual Perception
(1973)

			(Scale Score)			Level
Test		N	Mean	S.D.	"t"	of Sig.**
Eye-Motor Coordination	Pre-	17	9.1029	1.5156		
	Post-	17	9.5294	1.3831		
	*Gains		.4265	1.9620	.9861	N.S.
Figure-Ground	Pre-	17	9.6176	1.0793		
	Post-	17	9.7205	1.3859		
	Gains		-.1029	1.5513	1.0000	N.S.
Form Constancy	Pre-	17	8.6912	1.4184		
	Post-	17	9.2352	1.4265		
	Gains		.5440	1.2191	.5253	N.S.
Position in Space	Pre-	17	9.1000	1.5394		
	Post-	17	8.6294	1.6226		
	Gains		- .4706	1.7697	1.6915	N.S.
Spatial Relations	Pre-	17	9.1912	1.4830		
	Post-	17	9.2205	1.1280		
	Gains		.0293	1.2527	.5656	N.S.
Total	Pre-	17	45.7618	5.3866		
	Post-	17	46.3352	4.8200		
	Gains		.5734	5.1194	.2621	N.S.
Perceptual Quotient	Pre-	17	91.9647	13.8352		
	Post-	17	92.7294	10.9673		
	Gains		.7647	13.4328	.2347	N.S.

* Pre-test score subtracted from Post-test score
** Level of significance on two-tailed test

Statistics on the Metropolitan Reading Tests

Table XVII, page 233, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Metropolitan Reading Tests. Examination of Table XVII reveals that no significant gains were made in either Word Knowledge or Reading, the two categories of this test. In each category there were nonsignificant negative gains.

TABLE XVII

Mean Pre-test, Post-test, and Gains Scores of Elementary School Control Group on the Metropolitan Reading Tests (1973)

		(Raw Scores)				Level
Test		N	Mean	S.D.	"t"	of Sig.**
Word Knowledge	Pre-	14	22.2857	12.5540		
	Post-	14	21.3571	15.6037		
	*Gains		– .9286	7.6002	.4571	N.S.
Reading	Pre-	12	20.0833	8.0165		
	Post-	12	19.0000	10.5485		
	Gains		-1.0833	3.4234	1.0962	N.S.

* Pre-test score subtracted from Post-test score

** Level of significance on two-tailed test

Statistics on the Metropolitan Arithmetic Tests

Table XVIII, page 235, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Metropolitan Arithmetic Tests. Examination of Table XVIII reveals that no significant gains were made in either Computation or Problem Solving and Concepts, the two categories of this test. In each category there were non-significant negative gains.

TABLE XVIII

Mean Pre-test, Post-test, and Gains Scores of Elementary School Control Group on the Metropolitan Arithmetic Tests (1973)

Test		N	(Raw Scores) Mean	S.D.	"t"	Level of Sig.**
Computation	Pre-	14	18.7142	12.9045		
	Post-	14	18.0000	13.7225		
	*Gains		- .7142	3.7092	.7205	N.S.
Problem Solving and Concepts	Pre-	11	13.3636	10.5761		
	Post-	11	12.8181	11.5309		
	Gains		- .5455	1.5724	1.1504	N.S.

* Pre-test scores subtracted from Post-test scores

** Level of significance on two-tailed test

Statistics on the Gilmore Oral Reading Test

Table XIX, page 237, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Gilmore Oral Reading Test. Examination of Table XIX reveals that a significant gain occurred in the Comprehension Score. There were nonsignificant negative gains in the Accuracy Score and the Rate: Words per Minute.

TABLE XIX

Mean Pre-test, Post-test, and Gains Scores
of Elementary School Control Group
on the Gilmore Oral Reading Test
(1973)

Test		N	Mean	S.D.	"t"	Level of Sig.**
Accuracy Score	Pre-	17	15.0000	14.6201		
	Post-	17	14.8823	16.7886		
	*Gains		- .1177	5.7974	.0836	N.S.
Comprehension Score	Pre-	16	19.2500	9.9766		
	Post-	16	23.4375	8.4771		
	Gains		4.1875	4.7359	3.5367	.01
Rate: Words per Minute	Pre-	16	63.7500	43.5361		
	Post-	16	62.0599	45.7452		
	Gains		-1.7000	14.8898	.5044	N.S.

* Pre-test score subtracted from Post-test score
** Level of significance on two-tailed test

Statistics on the Test of Motor Tasks

Table XX, page 239, presents the mean pre-test, post-test, and gains scores, the standard deviations of those scores, and the "t" ratios of the control group on the Test of Motor Tasks. Examination of Table XX reveals that significant negative gain occurred in hopping and a positive gain approaching significance occurred in Ocular Pursuits: Tracking. All other gains were nonsignificant. Five additional tasks indicated nonsignificant positive gains, and 4 additional tasks indicated nonsignificant negative gains.

TABLE XX

Mean Pre-test, Post-test, and Gains Scores
of Elementary School Control Group
on Motor Tasks
(1973)

Task		N	Mean	S.D.	"t"	Level of Sig.**
Balance Beam Forwards	Pre-	17	4.4117	.9393		
	Post-	17	4.2352	1.2004		
	*Gains		- .1765	.8828	.8241	N.S.
Balance Beam Backwards	Pre-	17	3.0000	1.2747		
	Post-	17	2.8235	1.3800		
	Gains		- .1765	.7276	1.0000	N.S.
Balance Beam Sideways	Pre-	17	3.3529	1.1147		
	Post-	17	3.0588	1.1440		
	Gains		.2941	1.2631	.9600	N.S.
Balance Board	Pre-	17	3.5882	1.4602		
	Post-	17	4.0000	.9354		
	Gains		.4117	1.5024	1.1299	N.S.
Skipping	Pre-	17	4.1176	.8702		
	Post-	17	4.2941	.6859		
	Gains		- .1176	1.1114	.4364	N.S.
Hopping	Pre-	17	4.5882	.6183		
	Post-	17	4.1176	.6966		
	Gains		- .4706	.8744	2.2188	.05
Ocular Pursuits Tracking	Pre-	16	2.3125	.8732		
	Post-	16	2.6250	.5000		
	Gains		.3125	.7041	1.7751	.10
Convergence	Pre-	16	2.6250	.8850		
	Post-	16	2.8125	.7500		
	Gains		.1875	.8341	.8991	N.S.
Mirror Movement Hand Tapping	Pre-	17	1.7058	.9195		
	Post-	17	1.5294	.8744		
	***Gains		.1764	1.3339	.5454	N.S.
Finger Touching (Right Hand)	Pre-	17	2.1176	.9275		
	Post-	17	1.8235	.6359		
	***Gains		.2941	.7717	.5713	N.S.

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* Pre-test score subtracted from Post-test score

** Level of significance on two-tailed test

*** Post-test score subtracted from Pre-test score because lower score is more desirable

TABLE XX (Continued)

Mean Pre-test, Post-test, and Gains Scores
of Elementary School Control Group
on Motor Tasks
(1973)

Task		N	Mean	S.D.	"t"	Level of Sig.**
Finger	Pre-	17	1.9411	.5557		
Touching	Post-	17	1.8823	.9275		
(Left Hand)	***Gains		- .0588	.8992	.2696	N.S.

** Level of significance on two-tailed test

*** Post-test score subtracted from Pre-test score because lower score is more desirable

Intergroup Comparison of Extent of Remediation

It was hypothesized that the experimental and control groups would be significantly differentiated at the close of the experiment in perceptual, motor, reading, and arithmetical skills and that the experimental group would be significantly more affected in these areas than would the control group.

Statistics on the Slingerland Screening Tests for Identifying Children with Specific Language Disability

Table XXI, page 242, presents the intergroup differences with respect to mean gains scores on the Slingerland Screening Tests for Identifying Children with Specific Language Disability. Examination of Table XXI reveals that the experimental group trained with special methods of remediation failed to make any larger significant positive gains than the control in terms of reduction of errors. In one category only was there a significant difference between experimental and control groups and that was in Visual Perception-Memory-Kinesthetic where the control group showed a greater reduction of errors than the experimental group. In 7 of the remaining categories the gains were in favor of the control group although beneath the level of significance. In 4 of the 12 categories gains were in favor of the experimental group but beneath the level of significance.

TABLE XXI

Intergroup Differences of Mean Gains Scores on the Slingerland Screening Tests for Identifying Children with Specific Language Disability

(1973)

Test	Mean E-C*	"t"	Level of Significance**
Copying-Chart	-2.0461	.5875	N.S.
Copying-Page	-1.0434	.5535	N.S
Visual Perception-Memory	.8746	1.1060	N.S.
Visual Discrimination	- .0819	.3511	N.S.
Visual Perception-Memory -Kinesthetic	-2.3657	2.1898	.05
Auditory Recall (Letters)	- .1305	.3992	N.S.
Auditory Recall (Numbers)	- .1816	.4791	N.S.
Auditory Recall (Spelling)	.9948	.6796	N.S.
Auditory Sounds	- .1842	.0430	N.S.
Auditory Association	- .3478	.4380	N.S.
Total Errors	- .9370	.8529	N.S.
Total Errors Plus Self Corrections and Poor Formations	1.4755	1.2262	N.S.

* Mean gains scores of Control Group subtracted from same scores of the Experimental Group

** Level of significance on two-tailed test

Statistics on the Frostig Developmental Test of Visual Perception

Table XXII, page 244, presents the intergroup differences with respect to mean gains scores on the Frostig Developmental Test of Visual Perception and the "t" ratios. Examination of Table XXII reveals that the experimental group failed to make significantly larger gains than the control group in any category. In one category only was there a significant difference between experimental and control groups and that was in perception of form constancy where the control group showed greater gain than the experimental group. In all remaining categories except figure-ground perception the gains were in favor of the control group although beneath the level of significance.

TABLE XXII

Intergroup Differences of Mean Gains Scores on the Frostig Developmental Test of Visual Perception

(1973)

Test	Mean E-C*	"t"	Level of Significance**
Eye-Motor Coordination	-1.5305	1.7659	.10
Figure-Ground	- .1806	.1219	N.S.
Form Constancy	-1.1033	2.3995	.05
Position in Space	.7412	.7732	N.S.
Spatial Relations	- .1646	.4767	N.S.
Total Scaled Score	-2.0677	1.5019	N.S.
Perceptual Quotient	-3.8867	1.2233	N.S.

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Statistics on Metropolitan Reading Tests

Table XXIII, page 246, presents the intergroup differences of mean gains scores on the Metropolitan Reading Tests and the "t" ratios. Inspection of Table XXIII reveals no significant differences between experimental and control groups in terms of gains in word knowledge or reading with the direction of gains in favor of the control group.

TABLE XXIII

Intergroup Differences of Mean Gains Scores on the Metropolitan Reading Tests

(1973)

Test	Mean E–C*	"t"	Level of Significance **
Word Knowledge	– .6785	.3916	N.S.
Reading	– .5239	1.1930	N.S.

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Statistics on Metropolitan Arithmetic Tests

Table XXIV, page 248, presents the intergroup differences with respect to mean gains scores on the Metropolitan Arithmetic Tests and the "t" ratios. Inspection of Table XXIV reveals that gains were in favor of the experimental group over the control group but not to the level of significance. In the category of computation the difference between groups although approaching significance at the .05 level was significant only at the .10 level. In the category of problem solving and concepts, also, the greater gains of the experimental group were nonsignificant.

TABLE XXIV

Intergroup Differences of Mean Gains Scores on the Metropolitan Arithmetic Tests

(1973)

Test	Mean E-C*	"t"	Level of Significance**
Computation	2.6742	1.9897	.10
Problem Solving and Concepts	3.3455	1.2883	N.S.

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Statistics on Gilmore Oral Reading Test

Table XXV, page 250, presents the intergroup differences with respect to mean gains scores on the Gilmore Oral Reading Test and the "t" ratios. Inspection of Table XXV reveals that a greater gain was made by the experimental group in accuracy and that the difference is significant at the .05 level. The experimental group indicated negative gains over the control group in comprehension and rate but these differences were not significant at the .05 level.

TABLE XXV

Intergroup Differences of Mean Gains Scores on the Gilmore Oral Reading Test

(1973)

Test	Mean E–C*	"t"	Level of Significance **
Accuracy	3.1547	2.2653	.05
Comprehension	-1.8171	.1317	N.S.
Rate: Words per Minute	-3.5074	.7657	N.S.

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Statistics on Test of Motor Tasks

Table XXVI, page 252, presents the intergroup differences of mean gains scores on the Test of Motor Tasks and the "t" ratios. Examination of Table XXVI reveals that the experimental group made significantly greater gains than the control group on only one task--walking the balance beam backwards. On 7 of the 10 remaining tasks gains were in favor of the control group although not to the level of statistical significance. On the 3 remaining tasks gains favored the experimental group but not to the point of significance at the .05 level.

TABLE XXVI

Intergroup Differences of Mean Gains Scores on Motor Tasks (1973)

Task	Mean E-C*	"t"	Level of Significance**
Balance Beam Forwards	.2876	1.1122	N.S.
Balance Beam Backwards	.9853	3.1771	.01
Balance Beam Sideways	.2929	1.5818	N.S.
Balance Board	- .5968	.8181	N.S.
Skipping	.2413	.7252	N.S.
Hopping	.1740	.3710	N.S.
Ocular Pursuits			
Tracking	- .1829	.4578	N.S.
Convergence	- .2371	.9423	N.S.
Mirror Movement			
Hand Tapping	- .2752	.2511	N.S.
Finger Touching (Right Hand)	- .7385	.6719	N.S.
Finger Touching (Left Hand)	.0765	.4869	N.S.

* Mean gains scores of Control Group subtracted from same scores of Experimental Group

** Level of significance on two-tailed test

Summary

The intergroup differences are conveniently summarized in Table XXVII, page 254, Table XXVIII, page 255, Table XXIX, page 256, and Table XXX, page 257. On the basis of the total data concerning the experimental group and the control group as well as the intergroup comparisons, the following observations may be made:

1. Out of 37 possible test scores the experimental group made 16 positive gains, 5 of which were significant. Two were significant negative gains, and 19 were nonsignificant negative gains.
2. Out of 37 possible test scores the control group made 21 positive gains, 2 of which were significant. One score was a significant negative gain, 13 were nonsignificant negative gains. Two scores were zero.
3. An intergroup comparison showed the experimental group with 13 positive gains over the control group, 2 of which were significant. Two scores were significant negative gains and 22 scores were nonsignificant negative gains.

TABLE XXVII

Summary of Test Gains Favoring the Experimental Group with Significant Intergroup Differences

(1973)

Test	Level of Significance
Metropolitan Arithmetic Tests	
Computation	.10*
Gilmore Oral Reading Test	
Accuracy	.05
Motor Tasks Test	
Balance Beam Backwards	.01

* Approaching but less than significance

TABLE XXVIII

Summary of Gains Favoring the Experimental Group
with Nonsignificant Intergroup Differences
(1973)

Test	Level of Significance
Slingerland Screening Tests	
Visual Perception-Memory	N.S.
Auditory Recall	
Spelling	N.S.
Total Errors Plus Self-Corrections and Poor Formations	N.S.
Metropolitan Arithmetic Tests	
Computation	.10
Problem Solving and Concepts	N.S.
Motor Tasks Test	
Balance Beam	
Forwards	N.S.
Sideways	N.S.
Skipping	N.S.
Hopping	N.S.
Mirror Movement	
Finger Touching	
Left Hand	N.S.

TABLE XXIX

Summary of Gains Favoring the Control Group with Significant Intergroup Differences

(1973)

Test	Level of Significance
Slingerland Screening Tests	
Visual Perception-Memory -Kinesthetic	.05
Frostig Developmental Test	
Form Constancy	.05

TABLE XXX

Summary of Gains Favoring the Control Group with Nonsignificant Intergroup Differences (1973)

Test	Level of Significance
Slingerland Screening Tests	
Copying-Chart	N.S.
Copying-Page	N.S.
Visual Discrimination	N.S.
Auditory Recall	
Letters	N.S.
Numbers	N.S.
Auditory Sounds	N.S.
Auditory Association	N.S.
Total Errors	N.S.
Frostig Developmental Test	
Eye-Motor Coordination	N.S.
Figure-Ground	N.S.
Spatial Relations	N.S.
Total Scaled Score	N.S.
Perceptual Quotient	N.S.
Metropolitan Reading Test	
Word Knowledge	N.S.
Reading	N.S.
Gilmore Oral Reading Test	
Comprehension	N.S.
Rate: Words per Minute	N.S.
Motor Tasks Test	
Balance Board	N.S.
Ocular Pursuits	
Tracking	N.S.
Convergence	N.S.
Mirror Movement	
Hand Tapping	N.S.
Finger Touching	
Right Hand	N.S.

Conclusions

The following conclusions are drawn from the statistical analysis of the data:

1. The methods of remediation employed in this research enabled the pupils exposed to this training to gain significantly over pupils in a control group in Reading Accuracy on the Gilmore Oral Reading Test.
2. Pupils exposed to remediation training gained significantly over pupils in a control group in the attainment of equilibrium as demonstrated by performance in walking the balance beam backwards.
3. Pupils exposed to specified remediation methods gained, but not significantly, over pupils in a control group in Visual Perception-Memory, Auditory Recall (Spelling) and Reduction of Total Errors Plus Self-Corrections and Poor Formations as measured by Slingerland Screening Tests for Identifying Children with Specific Language Disability.
4. Remediation methods enabled pupils to gain, but not significantly, over pupils in a control group in Arithmetical Computation and Arithmetical Problem Solving and Concepts as measured by the Metropolitan Arithmetic Tests.
5. Remediation methods enabled pupils in an experimental group to gain, but not significantly, over pupils in a control group in the motor tasks of walking the balance beam forwards, walking the balance beam

sideways, skipping and hopping, as well as reduction of mirror movement as indicated by finger touching with the left hand.

6. Contrary to the hypothesis, remediation methods resulted in a control group gaining significantly over an experimental group in Visual Perception-Memory-Kinesthetic as measured by the Slingerland Screening Test for Identifying Children with a Specific Language Disability.

7. Contrary to the hypothesis, remediation methods resulted in a control group gaining significantly over an experimental group in Perception of Form Constancy as measured by the Frostig Developmental Test of Visual Perception.

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APPENDIX A

Balance Beam Falls	5 Excellent (0)	4 Good (1)	3 Fair (2-3)	2 poor (4-5)	1 Cannot Perform Task	Comments
Forwards						
Backwards						
sideways						
Balance Board						
Skipping						
Hopping						

Mirror Movement

	5 Extreme	4 Much	3 Moderate	2 Little	1 None
Hand Tapping					
Finger Touching					
R Hand					
L Hand					

Ocular Pursuits	3 Smooth	2 Jerky	1 Moves Head
Tracking			
Convergence			

Dominance	L	R
Telescope		
Hand		
Eye		
Foot		
Writing		

Name ____________________

Date ____________________

Rater ____________________

PART III

SUBJECTIVE OBSERVATIONS AND INTERPRETATIONS

CHAPTER I

PRESCHOOL PROGRAM

Transfer

The experimental test results leave little doubt that measurable gains can be achieved in virtually all perceptual-motor areas and in over-all cognitive functioning. When exposed to remedial treatment at a preschool age-level, children show constructive changes that are pronounced, sometimes even dramatic. Comparison of results of seperate years suggests that improvement is in direct proportion to the direction and degree of emphasis. When there is practice in a given area of function, measurable results are forthcoming. It also appears to be the case that when it is indicated to the child that transfer of performance is expected to additional situations and when practice in varied situations is encouraged, transfer of skill is accentuated. However, development in perceptual functions does not seem to be automatic in the sense that practice always produces improvement. From constant observation of teaching and monitoring of progress it appears to this researcher that directed perceptual-motor activities increase the probability of stabilized improvement only when certain internal maturational changes occur. As in Piagetian terms a child cannot be forced to move from one stage of intellectual development into another but must be "lured" or "enticed" as certain central nervous system conditions permit, likewise, visual and auditory perceptual skills appear to follow the same principle.

Acceleration

There appears to be some evidence that early perceptual-motor training fosters superior cognitive development. The relatively high frequency of advanced performance on the kindergarten level of children trained in the program supports this conclusion. Reading was not taught to children in the preschool program; only the underlying perceptual-motor skills were developed. Yet in many cases these children displayed superior acquisition of higher-level academic skills. In at least one instance a child was accelerated to the first grade upon the request of the public school kindergarten teacher. Hyperactivity, however, constituted the only significant problem. The need for a long-term follow-up of the children enrolled in the preschool program is apparent.

Consolidation

Consolidation of gains often appeared to take place during vacation periods. It became a necessary function of the director to nurture and sustain the faith of teachers in the working of unseen, internal mental processes in the direction of growth and maturity. After a two-week period such as a Christmas vacation, these processes came to fruition in new perceptual-motor proficiencies as well as increased impulse control.

Teacher Qualities

To achieve progress dyslexic preschool children require handling with unusual skills involving resourcefulness and personal maturity on the part of teachers. Hyperactivity and distractibility pose a formidable threat to the teacher who herself or himself does not "have it all together". Unless the teacher has already established a foundation of self-confidence in her or his own professional abilities, the experience of dealing with these children will almost inevitably shatter faith in one's competence. For teachers as well as preschool children participation in this program fostered personal growth. Regular daily staff meetings at the close of each day became a necessity, first, as a therapeutic outlet for frustrations of the teachers and, second, as an opportunity to devise new educational strategies based upon deliberate staff analysis of each child's situation. The demands of flexibility and versatility made upon teachers were therefore great requiring calm acceptance of the need for change of technique as a non-threatening demand. Only teachers who combined the flexibility and openness of youth with the professional confidence of maturity met these demands gracefully and effectively. It seems, to this researcher, a part of wisdom to seek older, more experienced teachers who have the unique personality characteristics of flexibility, versatility, and resourcefulness.

Without exception personal warmth on the part of the teacher was correlated with teaching success. The thrill of excitement over some small evidence of a child's progress seemed to be the hallmark of an effective teacher. The manifestation of mutual joy upon teacher and pupil meeting each other at the beginning of a new day was frequently apparent in the most effective learning situations.

Pupil Attitudes

Impulsivity was, at first, a baffling and threatening problem. Eventually, a series of techniques were evolved out of frustrating and painful experience. Never, to the knowledge of the director, was a child ever hit or treated disrespectfully. Every child had early and ample opportunity to learn that hurting another person was against the norms of the group. In the case of one child striking another the offending child was restrained by enveloping him in one's arms in a firm, yet affectionate, manner until aggressive urges subsided. The rejection of corporal methods placed the entire staff under a special duress to acquire personal qualities that merited emulation and techniques that fostered the child's discovery of more productive means of need satisfaction. Compassion, it was found, could become contagious. Often informal teaching experiences grew out of spontaneous situations such as the gentle preservation of an insect found on the basement floor and sometimes, too, the good-hearted recognition and calm acceptance of a child's need to destroy it. Eventually, new norms began to emerge in a genuine, natural, and authentic fashion.

Parental Attitudes

The home behavior of a child exposed to non-punitive measures was sometimes an initial expression of hostility in the form of verbal challenging and disobedience. Parents characteristically complained of this in early parent-teacher meetings. Later, such protests were often followed with apologies and even letters of profound appreciation for the marked changes in the self-control of their child especially when such observations were made by neighbors. While not without initial periods of doubt, this researcher concluded not only that "idealism" works but that it was the only thing that worked and that "idealism" is indeed a higher form of realism.

CHAPTER II

ELEMENTARY SCHOOL PROGRAM

Test Anxiety and Overloading

While fairly impressive pre- to post-testing gains were indicated for the 6-week intensive program of the summer of 1972, the failure to achieve significant gains during the subsequent program of the summer of 1973, was not only surprising but profoundly disappointing. This failure to achieve the expected gains appears to be primarily a function of curricular overloading and extreme test anxiety during the post-testing period.

The program of the summer of 1973, was by far the best organized, led by the most professionally qualified and experienced staff, and the most stringently disciplined of the three summer programs. Every effort was made to make the final summer program the capstone of the 3-year effort. The pressure placed upon the pupils proved to be too extreme producing reverse effects. By the time of the post-testing period which occurred during an intense, prolonged, and debilitating summer heat wave, children manifested extreme test anxiety. Some pupils refused to enter testing rooms. Others refused to participate even though present. Some children ran from their rooms and had to be brought in from the outside of the school. In contrast to the pre-testing session which involved test administration entirely on an individual basis, the post-testing sessions were conducted in group situations. Although the same outside testers were employed in both situations, fear in the group situation became contageous and highly disruptive of pupil performance. One negative learning from this research is that learning-disabled children cannot be overloaded and pressured no matter how skilled the teaching staff. They must be handled with sensitivity to their individual needs and capacities to assimilate and consolidate learning skills. Follow-up studies of subsequent regular school performance would be needed to assess possible remediation effects.

Self-esteem

On the basis of the results achieved during the summer program of 1972, much can be said in support of the possibilities for remediation of learning disabilities even at the higher grade levels in elementary school. As early as the 2nd grade level, some children show signs of intense anxiety born out of fear of making mistakes especially in reading and writing. Other children at this grade level respond to their failure with compensatory mechanisms such as negativism, rebellion, and varied forms of misbehavior. By the time of the 4th, 5th, or 6th grade level the loss of self-confidence is so pronounced that progress is virtually impossible without restoration of self-esteem through an intensely therapeutic relationship with a teacher or tutor.

Empathy and Rapport

Perceptual confusions lead to inability to accurately interpret visual symbols and result in blind trial and error eventually severing the nerve of endeavor. The process of improvement appears to begin not with the technical aspects of learning but with emotional considerations. It appears to this researcher that a teacher could have the technical knowledge accompanying the holding of a Ph.D. degree in learning disabilities and in the absence of capacity for empathy and rapport would fail miserably in the process of remediation.

Motivations appear most likely to be unlocked when the tutor or teacher is young enough not to arouse the usual negative reactions to authority figures, is emotionally warm, and is of the same sex as the pupil. In this context motivating identifications are most likely to develop. Especially with children of the lower socio-economic groups for whom education is not an important goal, through the identification process the tutor becomes a connecting link between the pupil and educational achievement.

Follow-up Difficulties

Although repeated efforts were made to statistically compare pre- and post-remediation progress in the regular schools, the obstacles proved to be at least temporarily insurrmountable. Differing grading systems from grade level to grade level and from school to school made precise quantification unfeasible. Attempt to develop a practicable system of follow-up analysis is contemplated.

Success Cases

Spectacular cases of academic improvement did occur. One 6th grade boy who was failing consistently before his participation in the 6-week intensive summer program became the recipient of the award for the most improved pupil in his school at the end of the following year. The Mother of another 3rd grade boy exclaimed, "I can't see how 6 short weeks could make such a difference. Last year he was failing in almost everything. Now he is getting all "A's" and "B's". Still another parent described her 6th grade son as previously hiding his report card because of numerous failures and continued, "Now he carries it with him as long as the school allows because of his pride in achieving all "A's" and "B's". Another Mother approached her 4th grade son's teacher before the first P.T.A. meeting saying, "Tell me what he has done now," only to be surprised by the teacher's response, "What happened to him over the summer? He is a changed boy."

Rebuilt Self-esteem

Once a pupil begins to experience some renewal of self-confidence born out of the faith and unconditional regard of the tutor and this is reinforced with the empirical observation of even minimal academic improvement, progress often accelerates at an unprecedented rate.

Because of the intensity of motivation some of the most spectacular examples of progress of remediation thus occur in the later grades of elementary school. The baleful effects of not being able to read and write intensify motivation to the point that once there is genuine evidence of success in overcoming perceptual confusions, the pupil often begins to find his own methods for learning effectively.

CHAPTER III

DEMONSTRATION EFFECTS

Professional and Public Awareness

As a demonstration project, the total program served to produce numerous constructive results. Local and more widely located school administrations were sensitized to the need for special provision for learning-disabled children. Teachers constantly visited both preschool and elementary school sessions and conferred with the project director regarding diagnosis and remediation. Teacher workships utilized the services of program staff members. Parents of children within the program as well as parents of children outside the program conferred with the project director and other staff members for guidance in the care of their children. Patience, understanding, hope, and cooperation with regualr school teachers was fostered. Public awareness was developed through speeches made to service clubs as well as P.T.A., church, and Headstart groups by the project director. Numerous articles based on the program were published in newspapers and periodicals. One notable example was the

March, 1975, issue of The Bates College Bulletin[1] devoted to childhood education.

College and University Curriculum Development

The demonstration effects of the project were notably apparent in terms of curriculum development on the college and university level. At Bates College the development of a course in psychological and educational testing, a course in learning disabilities, and supervised field work in the areas of screening, diagnosis, and remediation of learning disabilities were direct results of this project. An advanced graduate level learning disabilities course was instituted by the Lewiston-Auburn branch of the University of Maine and taught for three semesters by the project director.

Graduate Level Training and Career Influence

A score of tutorial staff members of the project were sufficiently inspired through their experience to seek graduate level training leading to higher degrees in the area of learning disabilities. Several such members were fortunate in receiving generous scholarships from outstanding university programs. Other members were sufficiently qualified to receive appointment to full-time specialist positions in public school programs and private school programs as well. It was the practice of the project director to seek out superior individuals with unusual professional promise and then to encourage pursuit of further training and to consider professional careers in the field of learning disabilities.

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[1] This publication received the national award for distinction from the American Alumni Council. A copy of the March, 1975, issue which features an article by the project director entitled, "Once There was a Little Boy" is included with this report.

Pediatric and Opthomologic Liason

The present project was not without influence upon the local members of the medical profession. Pediatricians frequently requested diagnostic reports on children tested under the auspices of the program. Many referrals were made to pediatricians by the project director on the basis of diagnostic study of numerous children. Cooperation, understanding, and enlightened treatment were fostered through these professional relationships. Beneficial cooperative relationships extended to the opthomological profession, also. In some instances the testing procedures employed in the program revealed suspected subtle visual defects not detected through the usual regular school eye examination procedures but were upon referral accurately diagnosed by a qualified opthomologist. Special cases examined by opthomologists were referred to the staff of the project and its consultants for perceptual assessment and prescriptive treatment.

CHAPTER IV

ADDITIONAL PROBLEMS AND NEEDS

Failure to Properly "Mainstream" Pupils

While the rapid development of programs within the framework of the regular schools is evident and to be applauded, certain attendant problems appear. In an effort to make learning disability programs a stabilized part of the public school structure, directors and specialists in the area of learning disabilities sometimes, to the detriment of pupils, seem unduly reticent to restore sufficiently rehabilitated children to the mainstream of regular classes. Budgetary consideration is dependent upon the number of children receiving specialized learning disability services and thus, in order to procure funds, a tendency toward what might be termed "empire building" emerges.

Undesirable "Half-way" Measures

At the other extreme, well-intended, "half-way" measures sometimes work to the pupil's disadvantage. A child diagnosed as severely learning-disabled is singled-out for specialized help, but due to lack of adequate space is placed at a desk in an open corridor where he is stigmatized as a "problem child" with the appearance that he is segregated for punitive purposes. The resulting effect is that his self-esteem is even further damaged.

Teacher Education

It is evident that there is still much need for administrative and teacher enlightenment concerning learning disability programs. While many teachers are enrolling in graduate level learning disability courses, these teachers are generally those who are already the most sensitive and open professional people. Many teachers need sound understanding of the nature of learning disabilities and desirable techniques for assisting learning-disabled children.

Prescriptive Services

The demands made upon the director of this present project for carefully written diagnostic and prescriptive reports pertaining to children tested under the auspices of this project were staggering. Requests still continue beyond the ability of this professional worker to meet them. The regular schools need much further assistance and generally recognize this need with due appreciation for and cooperation with outside help.

Tutorial Services

The additional help needed includes tutorial services. Sometimes schools have been able and willing to pay para-professionals and others such as minimally trained college students for tutorial services. In other instances these needed services have been rendered on a volunteer basis with encouraging results. There is much opportunity for intensive and extensive development of tutorial services.

Parental Education

There is need for an effective program of parental education concerning the nature of learning disabilities and the approaches that offer promise of effectiveness. Clear, concise, and sound written materials for parental consumption are needed. Joint conferences for parents, teachers, and specialists need broader implementation.

Elimination of Stigma

Finally, it must be made clear through every means available that different people learn in different ways. In the experience of the present researcher this explanation reduces the alarm of the parents and preserves the self-esteem of the pupil who is in academic difficulty. Furthermore, it is the obligation of society and especially the school to discover how each child learns best. When this is done, we must proceed to devise means of teaching along the lines of greatest effectiveness for each individual. With such an understanding a significant step will be taken toward the elimination of stigma, discouragement, and educational defeat.